A taxonomic revision of the genus *Zieria* Sm. (Rutaceae) in Queensland

Marco F. Duretto[1] & Paul I. Forster[2]

Summary

Duretto, M.F. & Forster, P.I. (2007). A taxonomic revision of the genus *Zieria* Sm. (Rutaceae) in Queensland. *Austrobaileya* 7(3): 473–544. A taxonomic revision of the genus *Zieria* Sm. in Queensland is presented with thirty-five species recognised. Sixteen new species are described and illustrated: *Z. actites* Duretto & P.I.Forst., *Z. alata* Duretto & P.I.Forst., *Z. bifida* Duretto & P.I.Forst., *Z. boolbunda* Duretto & P.I.Forst., *Z. cephalophila* Duretto & P.I.Forst., *Z. distans* Duretto & P.I.Forst., *Z. eungellaensis* Duretto & P.I.Forst., *Z. exsul* Duretto & P.I.Forst., *Z. graniticola* J.A.Armstr. ex Duretto & P.I.Forst., *Z. hydroscopica* Duretto & P.I.Forst., *Z. inexpectata* Duretto & P.I.Forst., *Z. insularis* Duretto & P.I.Forst., *Z. madida* Duretto & P.I.Forst., *Z. scopulus* Duretto & P.I.Forst., *Z. tenuis* Duretto & P.I.Forst. and *Z. vagans* Duretto & P.I.Forst. *Z. whitei* J.A.Armstr. ex Duretto & P.I.Forst. (based on *Z. aspalathoides* var. *intermedia* C.T.White) is newly recognised at specific rank and illustrated. *Z. compacta* C.T.White is reinstated at species level. *Z. fraseri* subsp. *robusta* (C.T.White) Duretto & P.I.Forst. is newly recognised at subspecific rank. An assessment is provided of the current conservation status for all *Zieria* taxa found in Queensland with occurrence in conservation reserves noted. New distributional information is given for various taxa. Keys to all taxa of *Zieria* found in Queensland are provided.

Key Words: Rutaceae, *Zieria*, *Zieria actites*, *Zieria alata*, *Zieria bifida*, *Zieria boolbunda*, *Zieria cephalophila*, *Zieria compacta*, *Zieria distans*, *Zieria eungellaensis*, *Zieria exsul*, *Zieria fraseri* subsp. *robusta*, *Zieria graniticola*, *Zieria hydroscopica*, *Zieria inexpectata*, *Zieria insularis*, *Zieria madida*, *Zieria scopulus*, *Zieria tenuis*, *Zieria vagans*, *Zieria whitei*, Australian flora, Queensland flora, new species, identification keys, conservation status codings

[1]M.F.Duretto, Tasmanian Herbarium, Tasmanian Museum and Art Gallery, Private Bag 4, Hobart, Tasmania 7001, Australia. Email: Marco.Duretto@tmag.tas.gov.au

[2]P.I.Forster, Queensland Herbarium, Environmental Protection Agency, Brisbane Botanic Gardens Mt Coot-tha, Mt Coot-tha Road, Toowong, Queensland 4066, Australia. Email: paul.forster@epa.qld.gov.au

Introduction

The genus *Zieria* Sm. is restricted to eastern Australia (Queensland, New South Wales, Victoria, South Australia and Tasmania) with the exception of one species, *Z. chevalieri* Virot, which is endemic to New Caledonia. A monograph of the genus was undertaken by Armstrong (1991a) and formally published (Armstrong 2002), with little subsequent updating, to recognise some 42 species and 16 subspecies (including typical subspecies). In his monograph Armstrong recognised 16 species and 12 subspecies of *Zieria* for the state of Queensland.

Much of the work presented in Armstrong's publication is based on collections incorporated into herbaria prior to around 1987, indeed many of his determinations on specimens at BRI date from the 1970s to 1982, with only a few further determinations through to 1992. There are now considerable additional specimens in herbaria such as BRI that have active collection programs. Some of these specimens do not belong to the taxa recognised by Armstrong (1991a, 2002) and have been given informal phrase names at BRI (e.g. in Forster 1997b, 2002, 2007). All of these new taxa are formally named in this paper. As well, we change the application of several names (e.g. *Z. fraseri*, *Z. robertsiorum*, *Z. montana*) and resurrect one taxon (*Z. compacta*) relegated by Armstrong to subspecific rank. Here we recognise 35 (23 endemic) species and ten (five endemic) subspecies of *Zieria* for Queensland. In total, *Zieria* contains 61 species and 16 subspecies.

Most of the previously undescribed taxa are relatively restricted in occurrence and either have or require conservation codings under Queensland legislation. Armstrong

---

Accepted for publication 1 June 2007

(2002) made many pronouncements on the conservation status of Queensland taxa of *Zieria,* although these were not necessarily in accordance with the way the taxa have been listed under Queensland legislation. Many of these pronouncements are incorrect in the light of herbarium collections over the last 20 years, and an up to date assessment of conservation status based on the IUCN criteria (IUCN 2001) of all Queensland taxa of *Zieria* is included here together with current or pending listings under the Queensland *Nature Conservation (Wildlife) Regulation* 2006 (*NCR* 2006).

Speciation Patterns

Speciation patterns in *Zieria* are complex, undoubtedly reflecting the evolutionary and climatic histories of the localities where they occur now and have in the past. Although Armstrong (2002) provided a morphologically based species phylogeny for the species of *Zieria* that he recognised, including the delimitation of species groups, it is likely that this is invalid in the light of the additional taxa now recognised.

The closest equivalent to *Zieria* in species distribution patterns may be found in the genus *Plectranthus* L.Her. (Lamiaceae) where there is a group of wide ranging taxa in conjunction with putatively recently evolved, narrowly distributed entities (Forster 1994a, 1997a). Narrowly distributed species of both *Plectranthus* and *Zieria* are often found on small isolated islands of rocky substrates (usually granite, rhyolite, sandstone, trachyte) surrounded by rainforest or more fire prone habitats. In these habitats, plants of *Zieria* may be narrowly distributed in clefts or crevices where little vegetation can establish or persist. Consequently many species of *Zieria* have populations that are small in size and prone to extinction due to disturbance (especially fire) (Fitzsimmons 1999), climate change (especially prolonged drought), genetic depauperation (Hogbin & Peakall 1999; Sharma 2001), weed infestation or other environmental variables.

Many species of both genera occur on inselbergs (isolated mountains), renowned worldwide for increased speciation rates in the taxa that are present (Porembski & Barthlott 2000; Burke 2003) driven by an ‘islands on islands’ effect (Porembski *et al.* 1997, 2000). The combination of population isolation, variable population sizes and the ability to colonise new habitats may well have driven speciation in these two genera. The varied range of microhabitats and edaphic conditions on inselbergs and other mountains in Queensland has provided numerous niches into which taxa of both *Plectranthus* and *Zieria* have speciated. Examples of *Zieria* species from Queensland that occur in rocky habitats (clefts and crevices on pavements and outcrops) on isolated mountains include *Z. actites, Z. alata*, *Z. boolbunda*, *Z. cephalophila*, *Z. compacta*, *Z. eungellaensis*, *Z. fraseri* subsp. *fraseri*, *Z. madida*, *Z. montana*, *Z. rimulosa*, *Z. robertsiorum* and *Z. scopulus.* Whether these mountainous habitats have acted as refugia for these species over time in the face of changing regional climates, or these species are recent autochthonous elements is unknown. However, unlike the situation in *Plectranthus* where plants are invariably found in open, rocky situations, many species of *Zieria* occur in the understorey of open forest and woodland. These forested habitats are often immediately adjacent to the rocky habitats, hence the possibility that allopatric speciation has occurred from species of these habitats into the rocky habitats is high, and vice versa. These patterns of allopatric speciation are thought to be responsible for the high diversity associated with the sparse vegetation on granite outcrops and adjacent, more developed vegetation in south-west Western Australia (Hopper *et al.* 1997).

Zieria and *Plectranthus* taxa provide unique examples of species radiation in changing environments with ‘core’ species in the more widespread (and possibly stable?) habitats and ‘refuge-endemics’ or ‘neo-endemics’ in restricted refugial habitats (most montane species) and newly available or transitory habitats such as ecotonal areas (e.g. *Z. bifida*, *Z. collina*). Many species from both genera (particularly *Plectranthus*) fit the ‘obligate-seeder’ model of Clarke (2002a,b), i.e. they are killed in fires and have to regenerate from seed. Evidence of resprouting by *Zieria* species after fire is equivocal (Auld 2001; Benson & McDougall 2001) and may be dependent on the presence of lignotubers (*cf.* Armstrong 1991a; Fitzsimmons 1999), a feature that is poorly documented for nearly all taxa. The species that occur in the open, rocky habitats are subjected to lower fire frequencies due to the inability of the vegetation cover to regularly sustain fire, so fit the 'refuge-endemic' model. Several species in this habitat type are known to resprout after fire (Auld 2001; Benson & McDougall 2001). Some species that occur in fire prone vegetation away from rock outcrops (e.g. *Z. collina*, *Z. laevigata*, *Z. smithii*, *Z. southwellii*) do not appear to possess lignotubers (Auld 2001; Fitzsimmons 1999) and may well be predominantly 'obligate-seeders'.

The two genera are also examples of 'non-adaptive radiation' accompanied by a 'high lineage diversification rate' with broad similarities to examples from the animal kingdom (e.g. *Albinaria* snails) where there are a lot of species that are similar in general morphology and habitat preferences but that occur in disjunct localities (Savolainen & Forest 2005).

In Queensland (Qld) the wide-ranging taxa (> five 1° grid cells of distribution) are *Zieria arborescens* subsp. *arborescens* (distributed mainly in New South Wales (NSW)), *Z. compacta*, *Z. cytisoides*, *Z. laevigata*, *Z. laxiflora* and *Z. smithii*. Taxa with a moderate distribution (2–5 1° grid cells; *in sense previously recognised by Armstrong 2002) are *Z. distans*, *Z. fraseri* subsp. *robusta*, **Z. furfuracea* subsp. *euthadenia*, *Z. inexpectata*, **Z. minutiflora* subsp. *minutiflora*, **Z. minutiflora* subsp. *trichocarpa*, *Z. robertsiorum*, **Z. southwellii* (distributed mainly in NSW), *Z. tenuis* and **Z. verrucosa*. Narrow-endemics (restricted to a single 1° grid cell but with more than one population; *in sense previously recognised by Armstrong 2002) are **Z. adenodonta*, *Z. alata*, **Z. arborescens* subsp. *glabrifolia*, **Z. aspalathoides* subsp. *brachyphylla*, *Z. bifida*, **Z. collina*, *Z. eungellaensis*, *Z. exsul*, *Z. fraseri* subsp. *fraseri*, **Z. furfuracea* subsp. *gymnocarpa*, *Z. graniticola*, *Z. insularis*, *Z. madida*, *Z. montana*, **Z. obovata*, **Z. rimulosa*, *Z. scopulus*, *Z. tenuis*, *Z. vagans* and *Z. whitei*. The newly described species *Z. actites*, *Z. boolbunda*, *Z. cephalophila* and *Z. hydroscopica* are currently known from single localities. It is worth noting that species of *Zieria* that are endemic to NSW and previously recognised by Armstrong (2002), *viz.* *Z. adenophora* Blakely, *Z. baeuerlenii* J.A.Armstr., *Z. granulata* C.Moore ex Benth., *Z. hindii* J.A.Armstr., *Z. ingramii* J.A.Armstr., *Z. lasiocaulis* J.A.Armstr. and *Z. prostrata* J.A.Armstr. are restricted to single 1° grid cells, and that *Z. buxijugum* J.D.Briggs & J.A.Armstr., *Z. covenyi* J.A.Armstr., *Z. floydii* J.A.Armstr., *Z. formosa* J.A.Armstr. and *Z. parrisiae* J.A.Armstr. are known from single populations. Hence, this proposed speciation pattern of a 'core' group of widespread species and relatively many narrowly distributed species, is prevalent throughout the geographic range of the genus in eastern Australia.

Materials and methods

This paper is primarily based on herbarium collections in BRI, HO, MEL and QRS, though specimens from CANB, NE and NSW have also been seen, and field collections and observations made mainly by the second author. Where we have listed additional collections for taxa recognised by Armstrong (2002), these are generally relatively recent (therefore the populations are probably still extant) and in addition to those cited, annotated, or listed in his list of exsiccatae, or add substantially to the distributional range known for the taxon as mapped in the 2002 monograph. We have especially cited material from National Parks or other conservation reserves to reinforce our statements on conservation status and to demonstrate which species are presently conserved. For species that also occur outside of Qld, we have generally not cited material except in instances where significant new distributional data is available (e.g. *Z. arborescens, Z. southwellii*).

For consistency, our descriptions are modelled on those of Armstrong. Minor notes about the descriptions are as follows –

(1) if an organ can be wholly described in terms of its indumentum cover, then this is made only once. Where parts of an organ differ in indumentum cover than this is separately described, e.g. gynoecium only versus separate ovary and style descriptions.

(2) length by width descriptions for organs are indicated as 'number × number' followed by the common measurement in mm.

In the following taxonomic treatment, species are listed alphabetically. All descriptions are based on collections made in Qld. All newly described taxa are endemic to Qld. New descriptions of some previously recognised taxa, e.g. *Z. compacta*, *Z. fraseri*, *Z. montana* and *Z. robertsiorum*, are given where the circumscription of these taxa differ somewhat from that of Armstrong (2002).

Species and subspecies are defined as previously outlined and applied in the Rutaceous genera *Boronia* (Duretto 1997, 1999a, 1999b, 2003; Duretto & Ladiges 1997), *Phebalium* (Forster 2003) and *Philotheca* (Forster 2005).

Common abbreviations in the specimen citations are L.A. (Logging Area), N.P. (National Park), S.F. or S.F.R. (State Forest Reserve). Cited specimens are arranged north to south within Queensland Pastoral Districts. Bioregion nomenclature is per Sattler & Williams (1999).

Taxonomy

Key to the species of *Zieria* found in Queensland

1. Leaves prominently glandular verrucose, if only on abaxial surface or margins or midrib 2
   Leaves not prominently glandular verrucose 12

2. Terminal leaflets elliptic to lanceolate, 1.5–15 mm wide, margins flat to slightly recurved 3
   Terminal leaflets narrow-lanceolate to narrow-elliptic to narrow-oblanceolate, 1–5.5 mm wide, margins usually strongly recurved to revolute though some leaves on an individual plant may be flat to slightly recurved 5

3. Abaxial surface of leaves stellate tomentose; fruit glabrous or hirsute . . . **16. Z. furfuracea**
   Abaxial surface of leaves glabrous to hirsute but not stellate tomentose; fruit glabrous 4

4. Stems prominently glandular verrucose, leaf decurrencies prominent . . . **7. Z. boolbunda**
   Stems not or slightly glandular verrucose, leaf decurrencies absent or very faint . . . . **30. Z. smithii**

5. Branches hirsute with simple, bifid and trifid hairs 6
   Branches glabrescent with scattered stellate hairs to stellate tomentose 7

6. Terminal leaflets greater than 7 mm long . . . . **17. Z. graniticola**
   Terminal leaflets to 7 mm long . . . . **19. Z. inexpectata**

7. Adaxial surface of leaflets with large hemispherical glands 8
   Adaxial surface of leaflets smooth or slightly glandular verrucose 9

8. Large hemispherical glands on adaxial surface of leaflets, young branches glabrous . . . . **2. Z. adenodonta**
   Large hemispherical glands on adaxial surface of leaflets, young branches hairy . . . . **34. Z. verrucosa**

9. Sepals glabrous or glabrescent on abaxial surface . . . . **9. Z. collina**
Sepals stellate tomentose on abaxial surface 10

10. Branches and even the glands usually, densely tomentose . . . . **33. Z. vagans**
Young branches glabrescent or with a sparse indumentum between the glands, glands mostly glabrous 11

11. Inflorescence 1–3-flowered; adaxial surface of leaflets glabrescent or with a sparse to moderately dense indumentum of minute stellate hairs . . **8. Z. cephalophila**
Inflorescence 3–20^{+}-flowered; adaxial surface of leaflets glabrescent with hairs along midrib and near tip only . . . . **12. Z. distans**

12. Epidermis of abaxial surface of leaflets completely hidden by dense stellate indumentum [midrib may be visible]. 13
Epidermis of abaxial surface of leaflets clearly visible, surface glabrous, glabrescent, variously pilose, or with a sparse to moderately dense stellate indumentum. 25

13. Adaxial surface of leaflets with a moderately dense to dense stellate indumentum (hairs may be minute) 14
Adaxial surface of leaflets glabrous or sparsely to densely pilose [rarely (*Z. collina*) with the occasional minute stellate hair amongst the many simple hairs]. 15

14. Leaflets elliptic to obovate with a length/width ratio 1.8–3.3, abaxial surface shaggy with hairs to 1 mm long, with prominently raised secondary veins; petals 3.6–6 mm long . . . . **11. Z. cytisoides**
Leaflets narrow-elliptic to oblong with a length/width ratio of 3.7–6, abaxial surface stellate tomentose with hairs less than 0.2 mm long, with obscure or slightly raised secondary veins; petals 2–2.5 mm long . . . . . . **32. Z. tenuis**

15. At least some terminal leaflets > 5 cm long; abaxial surface of sepals stellate tomentose . . . . **4. Z. arborescens**
Terminal leaflets < 4.5 cm long, if > 4.5 cm long then abaxial surface of sepals glabrous or glabrescent 16

16. Adaxial surface of leaflets hirsute, if glabrescent then leaflets obovate, 10–16 mm long; midvein on abaxial surface of leaflets hirsute; stems hirsute 17
Adaxial surface of leaflets glabrous, apart from few hairs along midrib; leaflets narrow elliptic to elliptic to slightly obovate, 10–43 mm long, midvein on abaxial surface glabrous or hirsute; stems glabrous or hirsute 20

17. Terminal leaflets obovate; petioles sparsely pilose, some bifid and stellate hairs present also; peduncles and pedicels glabrous . . . . **14. Z. exsul**
Terminal leaflet elliptic to lanceolate; petioles stellate tomentose; peduncles and pedicels with a sparse to dense indumentum. 18

18. Adaxial surface of leaves with simple and stellate hairs, rays *c.* 0.1 mm long; abaxial surface of sepals glabrous . . . . **9. Z. collina**
Adaxial surface of leaves with simple hairs, hairs 0.25–1 mm long; abaxial surface of sepals with a sparse to moderately dense indumentum. 19

19. Terminal leaflets elliptic, 3.5–10 mm wide, margins flat to recurved; petiole 3–8 mm long . . . . **10. Z. compacta** (Bull Creek Gorge)
Terminal leaflets narrow elliptic, 1–3 mm wide, margins recurved to revolute; petiole 0.5–1 mm long . . . . **35. Z. whitei**

20. Stems with an indumentum that is usually evenly distributed around stem though sometimes denser between decurrent leaf bases 21
Stems glabrous or hirsute between decurrent leaf bases only, other areas glabrous or glabrescent 23

21. Stems glandular verrucose . . . . **33. Z. vagans**
Stems not glandular verrucose 22

22. Leaflets elliptic to obovate, margin recurved [sometimes revolute on drying], tip subacute to rounded, minutely mucronate; the midrib of the abaxial surface has a stellate indumentum as or nearly as dense as that of lamina; pedicel with a moderately dense indumentum; sepal tip acute, inflexed [can be difficult to see]; cocci hirsute, if only on adaxial margin. . . . . **10. Z. compacta**
Leaflets narrow-elliptic to narrow-obovate, margin revolute, tip subulate to acute; the midrib of the abaxial surface glabrous or with indumentum markedly less dense than lamina; pedicel glabrous or with a sparse indumentum; sepal tip slightly acuminate, not inflexed; cocci glabrous . . . . **15. Z. fraseri**

23. Staminal filaments hirsute; sepals > 2 mm long . . . . **21. Z. laevigata**
Staminal filaments usually glabrous, rarely hirsute; sepals < 2 mm long 24

24. Branches without decurrent leaf bases, circular in cross section; leaflets usually with abaxial surface exposed, 1–6 mm wide . . . . **15. Z. fraseri** (Blackdown Tableland)
Branches with decurrent leaf bases, ± square in cross section; leaflets usually so revolute that abaxial surface hidden, 1–3.5 mm wide . . . . . **22. Z. laxiflora**

25. Inflorescence as long or longer than the subtending leaf. 26
Inflorescence shorter than the subtending leaf 37

26. Petioles to 1.5 mm long 27
Longer petioles 2–16 mm long 31

27. Leaflets obovate, margins flat to recurved, terminal leaflets (2–) 3–7 mm wide 28
Leaflets narrow elliptic to narrow obovate (rarely elliptic and then < 2.5 mm wide), margins usually recurved to revolute, terminal leaflets 0.5–3 mm wide [occasional simple leaf to 4 mm wide]. 29

28. Adaxial surface of leaflets densely pilose; at anthesis inflorescence shorter than leaves though sometimes longer when in fruit; fruit glabrous or hirsute . . . . **24. Z. minutiflora**
Adaxial surface of leaflets glabrescent to sparsely pilose; inflorescence at anthesis longer than leaves; fruit glabrous or glabrescent . . . . **26. Z. obovata**

29. Abaxial surface of leaflets glabrous or with an indumentum of simple and bifid hairs . . . . **5. Z. aspalathoides**
Abaxial surface of leaflets with a stellate indumentum 30

30. Leaflets with revolute margins and virtually no abaxial surface visible; abaxial surface of sepals with a sparse indumentum. . . . . . **5. Z. aspalathoides** (Moura)
Leaflets with recurved to revolute margins, many with clearly visible abaxial surface; abaxial surface of sepals with a moderately dense to dense indumentum . . . . **35. Z. whitei**

31. Abaxial surface of leaflets with a stellate indumentum; petioles to 16 mm long 32
Abaxial surface of leaflets with an indumentum of simple and/or bifid hairs, though a few stellate hairs may also be present; petioles to 7 mm long 34

32. Young branches with decurrent leaf bases . . . . . **28. Z. robertsiorum**
Young branches without decurrent leaf bases 33

33. Leaflets obovate . . . . . **26. Z. obovata**
Leaflets narrow elliptic to elliptic . . . . . **30. Z. smithii**

34. Young branches pilose, with hairs evenly distributed around stems; leaflets elliptic to obovate . . . . . **6. Z. bifida**
Young branches puberulous or pilose, with hairs much denser in or confined to area between decurrent leaf bases; leaflets narrow elliptic to elliptic to lanceolate 35

35. Branches slightly glandular verrucose . . . . . **17. Z. graniticola**
Branches smooth, not glandular verrucose 36

36. Abaxial surface of sepals with hairs scattered over entire surface . . . . . **20. Z. insularis**
Abaxial surface of sepals glabrous with hairs only at base . . . . . **27. Z. rimulosa**

37. Stems pilose, sometimes also with bifid and small stellate hairs 38
Stems glabrous, or stellate glabrescent to stellate tomentose 40

38. Abaxial surface of petals with scattered simple and bifid hairs . . . . . **6. Z. bifida**
Abaxial surface of petals with a dense stellate indumentum 39

39. Petioles to 1 mm long . . . . . **5. Z. aspalathoides**
Some petioles > 2 mm long . . . . . **17. Z. graniticola**

40. At least some of the terminal leaflets > 45 mm long 41
Terminal leaflets < 45 mm long 44

41. Abaxial surface of sepals glabrescent with few stellate hairs concentrated at base and/or on margins . . . . . **30. Z. smithii**
Abaxial surface of sepals stellate tomentose, at least between raised glands 42

42. Abaxial surface of leaflets hirsute to velutinous . . . . . **4. Z. arborescens**
Abaxial surface of leaflets glabrous or glabrescent 43

43. Peduncles glabrous or glabrescent; sepals > 1 mm long . . . . . **4. Z. arborescens**
Peduncles hirsute; sepals < 0.9 mm long . . . . . **31. Z. southwellii**

44. Young branches without decurrent leaf bases 45
Young branches with decurrent leaf bases 48

45. Petals 4–5.5 mm long . . . . . **31. Z. southwellii**
Petals 2–3 mm long 46

46. Adaxial surface of leaflets glabrescent or with scattered stellate and bifid hairs . . . . . **30. Z. smithii**
Adaxial surface of leaflets sparsely to densely pilose 47

47. Leaflets narrow elliptic to narrow lanceolate, adaxial surface of leaflets sparsely pilose . . . . . **18. Z. hydroscopica**
Leaflets obovate, adaxial surface of leaflets densely pilose . . . . . **24. Z. minutiflora**

48. Young branches with a sparse to dense indumentum, sometimes only between decurrent leaf bases 49
    Young branches glabrous or glabrescent 51

49. Abaxial surface of leaflets with a sparse to moderately dense stellate indumentum, sometimes only on midrib (close inspection may be required) . . . . **28. Z. robertsiorum**
    Abaxial surface of leaflets glabrous or glabrescent. 50

50. Branches with indumentum between decurrent leaf bases only, otherwise glabrous or glabrescent . . . .**7. Z. boolbunda**
    Branches with a moderately dense indumentum evenly spread around branches. . . . . **13. Z. eungellaensis** (Mt David)

51. Young branches without prominently raised decurrent leaf bases; abaxial surface of sepals glabrous 52
    Young branches with prominently raised decurrent leaf bases; abaxial surface of sepals with a stellate indumentum, at least at base 53

52. Young stems not glandular verrucose. . . . . **1. Z. actites**
    Young stems glandular verrucose (sometimes sparingly so) . . . . **29. Z. scopulus**

53. Inflorescence 10–20(–50)-flowered, most flowers opening at the same time . . . . **25. Z. montana**
    Inflorescence 1–10-flowered, 1–3 flowers opening at any one time 54

54. Largest leaflets < 15 mm long. . . . . . .**13. Z. eungellaensis** (Mt William, Mt Dalrymple)
    Largest leaflets > 15 mm long. 55

55. Tip of leaflets acute . . . . **3. Z. alata**
    Tip of leaflets obtuse . . . .**23. Z. madida**

1. Zieria actites Duretto & P.I.Forst., **species nova** *Z. compactae* C.T.White affinis a qua folioli laminis infra glabris (adversum dense stellato-tomentosa), costa supra non impressa (adversum valde impressa), marginibus folioli non recurvatis (in illa planis usque recurvatis) et petalo minore (1.8–2 × 0.9–1 mm adversum 3.5–5 × 1.2–3.3) differt. **Typus:** Queensland. Port Curtis District: Mt Larcom, 5 km NW of Yarwun, 25 January 1994, *P.I.Forster PIF14654* (holo: BRI; iso: MEL 306831).

Zieria sp. (Mt Larcom N.Gibson TOI8); Forster (1997b: 188; 2002: 181; 2007: 183).

Shrub to 1 m tall, forming a densely compact bush, glabrous or glabrescent with simple, bifid or stellate hairs on all parts apart from flowers. Stems erect, wiry; branches with slightly decurrent leaf bases, very weakly glandular verrucose. Leaves palmately trifoliolate, with an aniseed smell; petioles 2–10 mm long; terminal leaflets lanceolate to elliptic, (13–) 20–28 × 6.5–11 mm, laminae pellucid gland-dotted, not glandular verrucose, tips acute, margins crenulate and slightly recurved, midribs raised slightly abaxially and weakly glandular verrucose, secondary veins obscure; lateral leaflets similar to terminal leaflets but smaller, (10–) 15–22 × (4.5–) 7–9 mm. Inflorescence axillary, shorter than the subtending leaf, 9–20-flowered, not obviously glandular; peduncle 8–20 mm long; bracts linear-lanceolate, persistent, 1–3.5 mm long; secondary peduncles 3–6 mm long; pedicels 1.5–4 mm long, not obviously glandular, glabrous. Sepals deltate, 1–1.5 × *c.* 1 mm, imbricate in bud, not obviously glandular, tips acute, glabrous. Petals narrow-elliptic, 1.8–2 × 0.9–1 mm, cream to pale pink, imbricate in bud, not obviously glandular, with scattered stellate and simple hairs along margins of adaxial and abaxial surfaces. Staminal filaments 0.7–0.8 mm long, glabrous, eglandular; anthers *c.* 0.5 mm long, apiculum absent. Gynoecium glabrous. Cocci 3–3.5 × 1.8–2 mm, not glandular verrucose, glabrous, base of style persistent forming a minute apical apiculum. Seeds oblong-ovoid, 2.2–2.5 × 1.2–1.3 mm, black-purple, dull, slightly longitudinally striate. **Fig. 1.**

***Additional specimens examined*: Queensland.** PORT CURTIS DISTRICT: Top of Mt Larcom, Mar 1966, *Blake 22446* (BRI, CANB); 6 km NW of Yarwun, Mt Larcom, Mt Larcom Range, May 1988, *Gibson TO18* (BRI); Mt Larcom Peak, 7 km NW of Yarwun, Sep 1993, *Brushe 1358 & Williams* (BRI); Mt Larcom south peak, 17.5 km WNW of Gladstone, Apr 1995, *Brushe JB260 et al.* (BRI).

***Notes*:** *Zieria actites* appears to have some affinity to *Z. compacta*; however, *Z. actites* differs from that species in the leaf laminae being glabrous below (versus densely stellate tomentose), the midrib not impressed above (versus strongly impressed), the leaflet margins being thickened, but not recurved (versus flat to recurved) and the smaller petals (1.8–2 × 0.9–1 mm, versus 3.5–5 × 1.2–3.3 mm). Further affinities may be perhaps sought with *Z. montana* from which it can be distinguished in having slightly decurrent leaf bases on younger branches only (versus

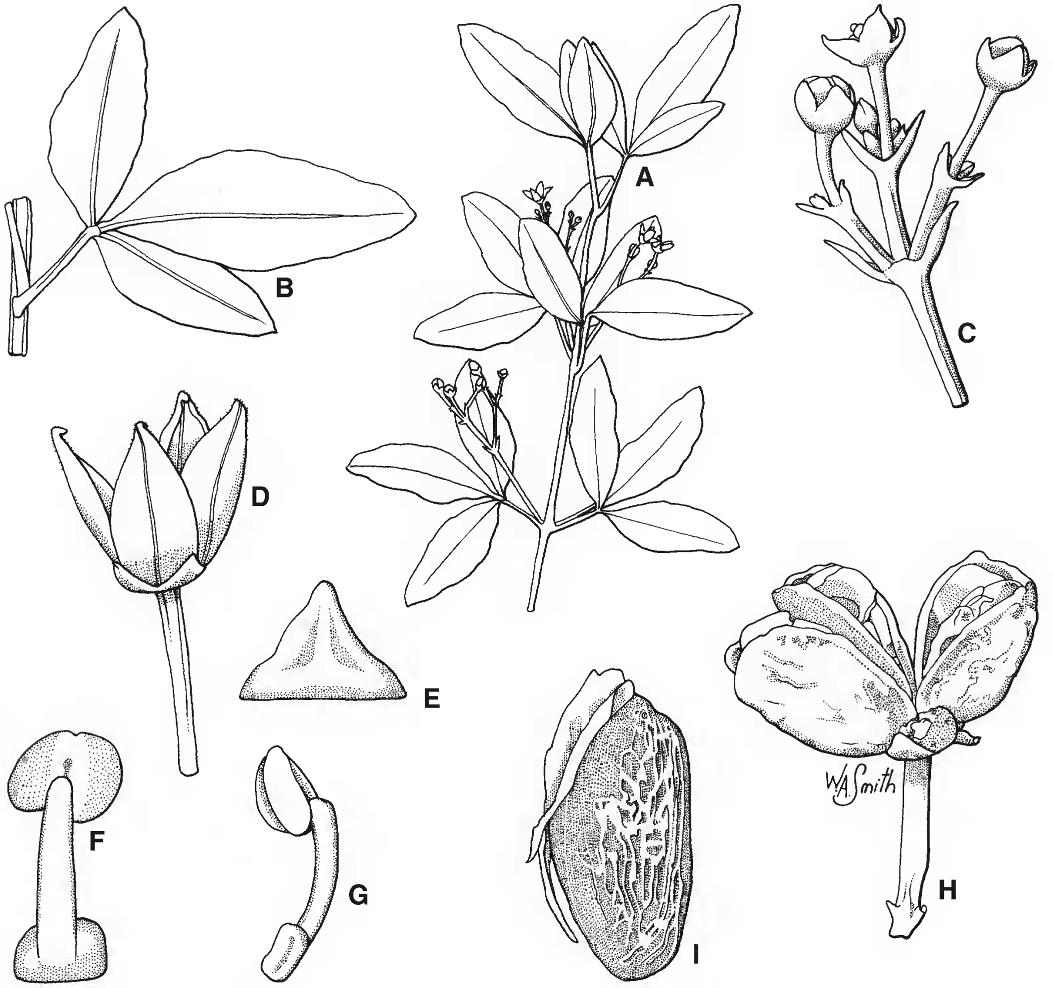


Fig. 1. ***Zieria actites.*** A. branch with several flowering inflorescences × 1. B. stem node with abaxial view of leaf × 2. C. inflorescence with flower and buds × 6. D. flower × 8. E. tip of sepal × 20. F–G. views of stamens × 20. H. mature fruit with multiple cocci × 8. I. lateral view of seed × 16. A–C from *Forster PIF14654* (BRI); D–I from *Gibson TO18* (BRI). Del. W. Smith.

prominently decurrent leaf bases) and crenulate leaf margins (versus margins entire or crenulate towards tip).

***Distribution and habitat*:** *Zieria actites* is endemic to Qld and is known only from the type locality of Mt Larcom (**Map 11**), an isolated peak composed of quartz alunite alteration of the Targinnie Quartz Monzonite (Willmott 2006), west northwest of Gladstone within the Brigalow Belt bioregion. At Mt Larcom the species is found in open woodland/shrubland in crevices and clefts on exposed outcrops and clifflines at *c.* 630 m.

***Phenology*:** Flowers, fruit and seed have been collected from September to May.

***Conservation status*:** Mt Larcom is not in a conservation reserve and with the walking track to the summit, is a popular destination for bushwalkers. The population of *Zieria* is not large (less than 1000 individuals) and the species can be assessed as **Endangered** under the criteria of B2a,b(i,ii,iii,v), C2a(ii) (IUCN 2001). Current threats are habitat destruction or amelioration by fire, weeds and general disturbance. It co-occurs with the Vulnerable listed *Parsonsia larcomensis* J.B.Williams.

***Etymology*:** The specific epithet is derived from the Greek *actites* (a watcher) and alludes to the populations of this plant occurring on the top of a mountain where the Pacific Ocean can be viewed.

2. Zieria adenodonta (F.Muell.) J.A.Armstr., *Austral. Syst. Bot.* 15: 299 (2002); *Zieria granulata* (F.Muell.) C.Moore ex Benth. var. *adenodonta* F.Muell., *Fragm.* 9: 116 (1875). **Type:** New South Wales. North Coast: Highest mountains on the Tweed, *Carron s.n.* (lecto [designated by Armstrong (2002: 299)]: MEL 62069; isolecto: MEL 62068, NSW 2565).

***Illustrations*:** Armstrong (2002: 300, 301); Logan River Branch SGAP (QLD Region) Inc. (2005: 363).

***Additional selected specimens examined*:** **Queensland.** Moreton District: Lower Bellbird Circuit track, Binna Burra section, Lamington N.P., 28°12′S, 153°11′E, Jul 1994, *Grimshaw G854* (BRI); Shipstern Range, northern ridge of MacPherson Range [Lamington N.P.], 28°12′S, 153°12′E, May 1969, *Telford 647* (CANB); Lamington N.P., Lower Ballanjui Track, near Yangahla Lookout, 28°12′S, 153°12′E, Sep 1978, *McDonald 2438* (BRI, CANB); Lamington N.P., on track to Ballanjui Falls, just below Yangahla Lookout, 28°13′S, 153°12′E, Dec 1986, *Beesley 999A & Ollerenshaw* (BRI, CANB; NSW *n.v.*).

***Distribution and habitat*:** This species has a limited distribution with populations on Mt Warning in NSW and in Lamington N.P. in Qld (**Map 12**) within the Southeast Queensland bioregion at or around Yangahla Lookout, Nixons Creek and Mt Roberts. Plants grow in open areas on rock-pavement (rhyolite) often in shrubland dominated by *Leptospermum petersonii* and *Lophostemon confertus* or in tall open forest of *Eucalyptus campanulata*, *E. microcorys* and *L. confertus* on basalt. It may possibly be stimulated by disturbance, as is *Z. collina* (Fitzsimmons 1999), such as would occur from occasional storm damage or fire.

***Phenology*:** Flowers have been collected from May to September, and fruit from November to January.

***Conservation status*:** This species is currently listed as **Rare** in Qld (*NCR* 2006). It has been infrequently collected with most collections in Qld from near or around Yangahla Lookout. This is perhaps more a reflection of its occurrence in long-standing National Parks than true rarity, but the exclusion of fire from some of its N.P. habitat may mean that little recruitment occurs. Grimshaw in his *G854* specimen label notes recorded it as uncommon.

3. Zieria alata Duretto & P.I.Forst., **species nova** a *Z. montana* J.A.Armstr. floribus paucioribus in quaque inflorescentia (3–12 adversum 10–20+), decurrentiis folii manifeste (adversum leviter vel non) glandulari-verrucosis et foliis acutis (non obtusis) differt. **Typus:** Queensland. Cook District: North Mary Logging Area, State Forest 143, 16°31′S, 145°16′E, 17 July 1994, *P.I.Forster PIF15630, G.Sankowsky & M.C.Tucker* (holo: BRI; iso: MEL, NSW).

Shrub to 3 m tall forming an open, somewhat straggly bush. Stems erect to decumbent, wiry; branches with prominent, narrow and raised decurrent leaf bases, prominently glandular verrucose especially along decurrent leaf bases, glabrous to glabrescent; older branches not lenticellate and corky, conspicuously scarred from the fallen buds and leaves. Leaves palmately trifoliolate; petioles (8–) 12–18 mm long, very slightly glandular verrucose, glabrous or glabrescent; terminal leaflets elliptic to obovate, 22–41 × 7–13 mm, laminae not glandular verrucose, glabrous, tips acute, margins entire or crenulate towards tip, flat, midveins raised abaxially, secondary veins obscure; lateral leaflets similar to terminal leaflets and usually *c.* the same length. Inflorescence axillary, shorter than the subtending leaf, 3–7 (–12)-flowered, only 1–3 flowers opening at a time; peduncle 8–16 mm long, with prominent ridges, glandular verrucose, glabrous or glabrescent; bracts scale like, persistent, slightly glandular verrucose, stellate glabrescent; pedicels 2–2.5 mm long, prominently ridged, sparsely stellate tomentose. Sepals broadly deltate, *c.* 0.7 mm long and wide, slightly imbricate in bud, not or slightly glandular verrucose, tips acute, adaxial surfaces glabrous, abaxial surfaces sparsely stellate pubescent at the base. Petals elliptic, 3.5–4 × 1.7–2 mm, white to cream to pale pink, dotted with pellucid glands abaxially, stellate pubescent on both surfaces. Staminal filaments 1.5–1.7 mm long, glabrous or with few small hairs, particularly towards the apex, slightly glandular distally; anthers 0.5–0.6 mm long, apiculum absent. Gynoecium glabrous. Cocci *c.* 3 × 1.7 mm, smooth, glabrous, base of style persistent forming a minute apical apiculum. Mature seeds not observed. **Fig. 2.**

Additional selected specimens examined**: Queensland.** Cook District: Devil's Thumb [Daintree N.P.], 16°23′S, 145°17′E, Sep 1997, *Jago 4501* (BRI); Mt Lewis, 27 km from the Rex highway on the main forestry road, 16°30′S, 145°16′E, Sep 1986, *Clarkson 6565* (BRI, MEL); S.F.R. 143, North Mary L.A., 16°13′S, 145°15′E, Jul 1977, *Gray 614* (BRI, NSW); S.F.R. 143, North Mary L.A., 16°32′S, 145°16′E, Nov 1995, *Gray 6405* (QRS); *c.* 1 km west of Mt Lewis road, 16°31′S, 145°16′E, Sep 1996, *Jago 4103* (BRI, DNA); Mt Lewis, 16°31′S, 145°16′E, Apr 1998, *Wannan 754 & Jago* (NSW); S.F. 143, North Mary L.A., 27 km along Mt Lewis road, 16°31′S, 145°16′E, Mar 2001, *Forster PIF26979 et al.* (BRI, HO, MEL); Ridge top above Mt Lewis road, 16°31′S, 145°17′E, Aug 1986, *Weston 756 et al.* (NSW); Mt Lewis, 16°35′S, 145°17′E, Aug 1996, *Telford 12215 & Donaldson* (BRI, CANB, NE, NSW).

Notes**:** Collections of *Zieria alata* were formerly included within the broad concept for *Z. montana* (Armstrong 1991a; 2002). There is a considerable latitudinal geographic disjunction between the type locality of *Z. montana* and the populations on Mt Lewis and the Devil's Thumb. *Z. alata* differs from *Z. montana* by having fewer flowers per inflorescence (3–12, verses 10–20+), markedly glandular verrucose leaf decurrencies (versus slightly or not so) and acute leaves (versus obtuse).

Zieria alata appears to be closely allied to *Z. madida* Duretto & P.I.Forst., but differs from that species in the leaf bases being prominently glandular verrucose (versus not or slightly glandular verrucose), leaflets with acute tips (versus obtuse) and the peduncles being glandular verrucose (versus not). The similar general morphology and occurrence of these two taxa in similar habitats within the Wet Tropics bioregion may indicate that they are closely related taxa.

Distribution and habitat**:** *Zieria alata* is endemic to Qld where it is narrowly distributed in the Wet Tropics bioregion (**Map 12**). It is apparently confined to areas over 1000 m in the Main Coast Range to the west of the Daintree River and Mossman that includes Mt Lewis and the Devil's Thumb. The species is found in windswept heath (with *Acrothamnus spathaceus, Leptospermum wooroonooran* and *Paphia meiniana*) and stunted closed forest (e.g. complex notophyll vine forest and evergreen microphyll moss-fern thicket) in clefts and crevices or areas of monocotyledon-dominated mats amongst boulders or on pavements of granite.

Phenology**:** Flowers have been collected in March and from July to September, and fruit in March, July and September.

Conservation status**:** This species can be locally frequent (*Telford 12215*) or occasional (*Forster PIF26979*) where found; however, the available habitat of granite domes and pavements is small. Nearly all of the cited collections have been made within 1 km of the Mt Lewis forestry road and the species should be searched for in similar habitats near Black Mountain and Mt Spurgeon in the

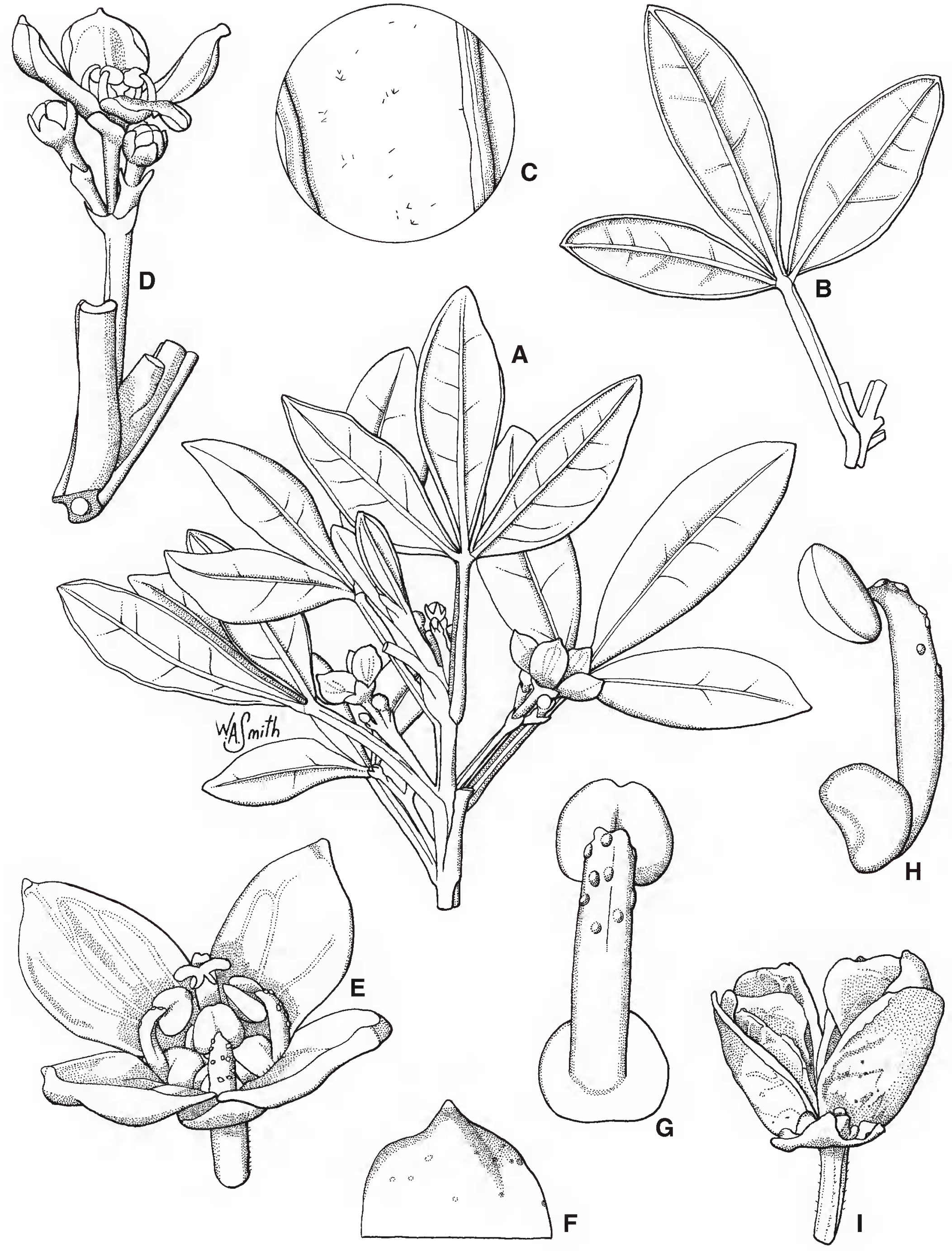


Fig. 2. ***Zieria alata.*** A. branch with several flowering inflorescences × 2. B. stem node with abaxial view of leaf × 2. C. detail of indumentum on abaxial surface of leaflet × 8. D. inflorescence with flower and buds × 4. E. flower × 8. F. tip of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. A–C from *Forster PIF26979* (BRI); D–I from *Forster PIF15630* (BRI). Del. W. Smith.

same range. No detailed assessment has been made of the number of populations, number of individuals, the area of occupancy or perceived threats for this species; however it can be assessed as **Vulnerable** under the D2 criterion (IUCN 2001) purely on the restricted distribution.

Etymology**:** The specific epithet is derived from the Latin *alatus* (winged) and alludes to the prominently decurrent leaf bases on young branches, which are the most prominent for this group of species.

4. Zieria arborescens Sims, *Bot. Mag.* 34: t. 1395 (1811). **Type:** Tasmania. MIDLANDS: Port Dalrymple, 1802–5, *R.Brown 5279* (lecto [designated by Armstrong (2002: 307)]: BM 630980 [images BRI, HO 534650]; isolecto: BM 630979 [images BRI, HO 534649], K 347902 [images BRI, HO 534660], MEL [61987, 61992]).

Notes**:** Armstrong (2002) recognised three subspecies in *Zieria arborescens* with *Z. arborescens* subsp. *arborescens* and *Z. arborescens* subsp. *glabrifolia* in Qld. The characters used to distinguish these last two subspecies are mutually exclusive in Qld though when material from other states is used then Armstrong's key to the subspecies does not work.

Key to the subspecies of *Z. arborescens* found in Queensland

1. Abaxial surface of leaflets with dense indumentum . . . . subsp. **arborescens**
   Abaxial surface of leaflets glabrous or glabrescent. . . . . subsp. **glabrifolia**

4a. Zieria arborescens Sims subsp. arborescens

Illustrations**:** Armstrong (2002: 308, 309); Logan River Branch SGAP (QLD Region) Inc. (2005: 363) [as *Z. arborescens*].

Additional selected specimens examined**: Queensland.** MORETON DISTRICT: 1.2 km along Carrick road, Springbrook, 28°11′S, 153°16′E, Oct 1997, *Bean 12487* (BRI, MEL, NSW); Start of Dave's Creek track, Binna Burra, Lamington N.P., 28°12′S, 153°11′E, Oct 1998, *Leiper s.n.* (BRI [AQ664305]); Dave's Creek circuit walking track, Dave's Creek, Binna Burra Section, Lamington N.P., 28°13′S, 153°12′E, Jul 1994, *Grimshaw G882 & Flenady* (BRI); Springbrook, 28°14′S, 153°16′E, Sep 1990, *Leiper s.n.* (BRI [AQ473933]); Springbrook, 28°14′S, 153°17′E, Dec 1993, *Bean 7175* (AD, BRI, CANB, NSW).

Distribution and habitat**:** *Zieria arborescens* subsp. *arborescens* is widespread in south-eastern Australia, with populations in Tasmania, and on mainland Australia from Victoria up to the extreme south-eastern corner of Qld at the Springbrook and Lamington plateaux within the Southeast Queensland bioregion (**Map 5**). There is also an isolated population at Mt Norman in Girraween N.P. near Stanthorpe within the New England Tableland bioregion. On the Springbrook and Lamington plateaux plants occur in 'wet' open eucalypt forest dominated by canopy species such as *Eucalyptus campanulata* and *Allocasuarina torulosa*, often with mixed rainforest taxa in the understorey, on substrates derived from basalt or rhyolite. At Mt Norman *Z. arborescens* subsp. *arborescens* grows amongst massive granite boulders.

Phenology**:** Flowers have been collected from August to October, and fruit from October to December.

Conservation status**:** This subspecies is common and widespread with the Qld populations mainly found in National Parks such as Girraween, Lamington and Springbrook. The population at Mt Norman, Girraween N.P., is small and quite disjunct from other populations. This population is geographically very close to, but at a much higher altitude, than populations of *Z. arborescens* subsp. *glabrifolia*. The conservation status is assessed as **Least Concern** (IUCN 2001).

4b. Zieria arborescens subsp. **glabrifolia** J.A.Armstr., *Austral. Syst. Bot.* 15: 312 (2002). **Type:** Queensland. DARLING DOWNS DISTRICT: Baboon Gully, Girraween National Park, *c.* 2 km N of Ranger Station, 28°50′S, 151°55′E, 28 September 1977, *J.A.Armstrong 1153* (holo: NSW 458810; iso [as per Armstrong (2002)]: BRI, CANB *n.v.*, MEL 2281421, PERTH *n.v.*).

***Additional specimens examined*: New South Wales.** Northern Tablelands: Bismuth Falls, WSW of Torrington, 29°17′S, 151°45′E, Oct 1990, *Williams & White NRAC4* (BRI, CANB *n.v.*, NE, NSW *n.v.*); Bismuth Falls, Torrington, 29°17′S, 151°45′E, Oct 1991, *Williams & White s.n.* (NE 58268).

***Notes*:** This subspecies was distinguished from *Z. arborescens* subsp. *arborescens* by Armstrong (2002) on the leaves being glabrous below (versus hirsute to densely stellate-tomentose), the petiole being glabrous abaxially (versus stellate-tomentose) and the peduncle being glabrous or with scattered stellate hairs (versus tomentose with stellate hairs). This distinction does not always work with material outside Qld (see *Notes* under *Z. arborescens*).

***Distribution and habitat*:** Armstrong (2002) considered *Zieria arborescens* subsp. *glabrifolia* to be endemic to Qld.

In Qld, *Zieria arborescens* subsp. *glabrifolia* is narrowly distributed in the New England Tableland bioregion (**Map 6**). It has been found in Girraween N.P., at Baboon Gully [type locality] and Bald Rock Creek, and near Stanthorpe at Donnelley's Castle and Jolly's Falls. In NSW, it has been collected from Bismuth Falls near Torrington, Northern Tablelands, NSW. At Baboon Gully and Bismuth Falls plants were collected in dry sclerophyll forest on granite.

***Phenology*:** Flowers have been collected in September and October, and fruit in October.

***Conservation status*:** The most recent collection of this subspecies in Qld was made in 1983 from Donnelley's Castle. Collections from the other cited Qld localities were all made in the early 1970s. Survey work to determine the number of extant populations, number of individuals, area of occupancy and perceived threats is urgently required to enable an accurate conservation status to be determined. An **Endangered** conservation status is appropriate on the criteria of B2a,b(i-v) (IUCN 2001). Paucity of collections, apparent restricted and often disjunct distributional patterns appear to be common features for taxa of Rutaceae that are restricted to the 'Granite Belt' of Qld (see also *Z. graniticola* below, and Duretto (1999a, 1999b, 2003) and Duretto *et al.* (2005) for discussions on species of *Boronia*).

***Notes*:** The recent two collections (see *Distribution and habitat*) from Bismuth Falls (NSW) are a good match for *Z. arborescens* subsp. *glabrifolia* though they do appear to have larger leaflets, peduncles, bracts and pedicels. Further field research is required to determine if this variation warrents taxonomic recognition.

5. Zieria aspalathoides A.Cunn. ex Benth., *Fl. Austral.* 1: 305 (1863). **Type:** Queensland. Darling Downs District [probably]: The Grampians, gathered on a range of Granite Mountains in lat. 28°40′S, long. *c.* 152°, June 1827, *A.Cunningham 39* (lecto [designated by Armstrong (2002: 313)]: K 347907 [Alan Cunningham's Australian Herbarium; images BRI, HO 534659]; isolecto: BM 829821 [images BRI, HO 534652], BRI [AQ318520] [specimen on right hand side of sheet]).

***Notes*:** Armstrong (2002) chose to recognise some populations on the Blackdown Tableland as *Z. aspalathoides* subsp. *brachyphylla*. He used three character states to distinguish between the two subspecies of *Z. aspalathoides*: *viz*., paraphrasing Armstrong, leaflet lamina generally 5–8 mm long (subsp. *aspalathoides*) or less than 2.5 mm long (subsp. *brachyphylla*), younger branches commonly with a line of simple hairs arranged in an alleotrichous configuration (subsp. *aspalathoides*) or younger branches entirely hirsute (subsp. *brachyphylla*), and inflorescences mostly 3-flowered (range 1–13) (subsp. *aspalathoides*) or inflorescences mostly 1-flowered (range 1–3) (subsp. *brachyphylla*). Of these three characters only the first is useful in distinguishing these taxa. Many specimens of *Z. aspalathoides* subsp. *aspalathoides* have 1-flowered inflorescences and hairs distributed over the entire stem. The type material of *Z. aspalathoides* subsp. *brachyphylla* has stems with the density of hairs between the decurrent leaf bases much greater than that of the other areas (as with the typical subspecies). Even leaf length is problematic as some specimens of *Z. aspalathoides* subsp. *aspalathoides* from the Springsure area (e.g. *Ballingal 2603*, *Cockburn s.n.* [AQ195493], *Gittins T67*) have very small leaflets (2–5 mm long).

These two subspecies are recognised here and *Zieria aspalathoides* subsp. *brachyphylla* is considered to be restricted to the Blackdown Tableland. *Z. aspalathoides* subsp *aspalathoides* is also found on the Blackdown Tableland. Detailed population studies are required on the Blackdown Tableland and in the Springsure area to determine if this classification is warranted or whether it is merely extreme variation. This pattern of variation has also been observed in *Boronia obovata* C.T.White, which is also present in the Blackdown Tableland area and displays a wide range in leaflet size (range 6–42 mm long) with some plants having only very small leaflets while others have relatively large leaflets. Use of herbarium collections alone suggested that there were maybe two taxa. Fieldwork has shown that, in the case of *B. obovata*, leaflet size is not consistent in a population, and is dependent on the amount of exposure and/or on the age of the plant (MFD, pers. obs 1992; PIF, pers. obs. 2005), and so, not a reliable character for taxonomic use (Duretto 1999a). This has also proved to be the case in some other species of *Boronia* (*cf.* Duretto 1999a, 1999b, 2003).

Several new taxa allied to *Zieria aspalathoides* are described in this paper (see accounts of *Z. graniticola*, *Z. inexpectata* and *Z. whitei*). See also the discussion under *Z. aspalathoides* subsp. *aspalathoides.*

Key to the subspecies of *Z. aspalathoides*

1. At least some leaflets > 4 mm long . . . . subsp. **aspalathoides**
   Leaflets < 3 mm long . . . . subsp. **brachyphylla**

5a. Zieria aspalathoides A.Cunn. ex Benth. subsp. aspalathoides

Zieria aspalathoides var. (Springsure L.Cockburn AQ195493); Forster (2002: 181).

***Illustrations*:** Williams (1987: 319) [as *Z. aspalathoides*]; Pearson & Pearson (1989: 403) [as *Z. aspalathoides*]; Armstrong (2002: 315, 316).

***Additional selected specimens examined*:** **Queensland.** Cook District: Wollem Trig – Atherton, 17°16′S, 145°27′E, Sep 1980, *Hind 2680* (NSW). North Kennedy District: Herberton, Jan 1912, *Kenny s.n.* (BRI [AQ195487]); Marble Creek mesa, SE of Greenvale, 19°07′S, 145°14′E, Apr 1991, *Bean 2918* (BRI); Mingela Bluff, 'Maidavale', E of Mingela, 19°53′S, 146°43′E, Apr 1991, *Bean 2975* (BRI); 6 km NNW of 'Liontown', Just Range area, 20°21′S, 146°01′E, Nov 1991, *Thompson 404 & Robins* (BRI); 9.2 km SSE from 'Redcliffe Vale', 21°11′S, 148°09′E, Nov 2000, *Perry & Lawler s.n.* (BRI [AQ498312]). Warrego District: 8 km E Chesterton N.P. house, Chesterton N.P., 40 km NE of Morven, 26°08′S, 147°16′E, Nov 1995, *Dollery s.n.* (BRI [AQ489935]). Leichhardt District: Ropers Peak, Peak Range, 22°52′S, 148°13′E, Aug 1990, *Forster PIF7213* (BISH, BRI, CANB, MEL); Two Mile Creek, Blackdown Tableland [N.P.], SE of Blackwater, 23°45′S, 149°06′E, Jan 1996, *Bean 9625* (BRI); Oakey Creek, 24°12′S, 148°10′E, Jul 1986, *O'Keefe 842* (BRI); *c.* 80 km SW of Springsure to Tambo road, 24°22′S, 147°15′E, Sep 1990, *Ballingall 2603* (BRI); Palmgrove N.P., Bigge Range, NW of Taroom, 24°53′S, 149°27′E, Sep 1999, *Forster PIF24748 & Booth* (BRI, MEL); Palmgrove N.P., NW of Taroom, 25°01′S, 149°16′E, Nov 1998, *Forster PIF23644 & Booth* (AD, BRI, MEL); Isla Gorge N.P., hill W of Leichhardt Highway, 55 km NNE of Taroom, 25°10′S, 150°00′E, Aug 1997, *Halford Q3346B & Holland* (BRI); Precipice N.P., catchment of Cables Creek, 25°23′S, 150°07′E, Sep 1996, *Forster PIF19776* (BRI); 2 miles [3.3 km] N of 'Mt Playfair', 90 miles SW of Springsure, Aug 1966, *Gittins T67* (BRI); East of 'Mantuan Downs' Station towards Springsure, Aug 1962, *Cockburn s.n.* (BRI [AQ195493]); W of Moura, Apr 1961, *Jones 1809* (BRI); 14 km N of Gurulmundi on Woleebee road, Sep 1973, *Trapnell 309 & Williams* (BRI). Burnett District: 3 km W of Cynthia, S of Monto, 25°12′S, 151°06′E, Sep 1999, *Bean 15296 & McDonald* (BRI). Darling Downs District: Percy Grant road, Barakula S.F., N of Chinchilla, 26°22′S, 150°44′E, Apr 1989, *Bean 1033* (BRI); Dalby – Durong road, 2.4 km S of Darr Creek crossroads, 26°34′S, 151°07′E, Nov 1997, *Bean 12550* (BRI); Near fire tower site, Nudley S.F. 93, *c.* 20 km NNW of Jandowae, 26°35′S, 151°01′E, Dec 1997, *Bean 12644* (BRI); Peters road, N of Cooby Dam, N of Toowoomba, 27°21'S, 151°56'E, May 1997, *Bean 11985* (BRI); Bony Mt, 14 km SW of Allora, 28°06′S, 151°52′E, Aug 1999, *Bean 15256* (BRI, MEL, NSW); Headwaters of Pariagara Creek, 7 km W of Bringalily Forestry Lookout Fire Tower, 28°11′S, 151°02′E, Sep 1992, *Forster PIF11660* (BRI, MEL, NSW); Red Rock Gorge, Sundown N.P., Aug 1983, *Haselgrove SD55* (BRI); Mt Jibbinbar, Sundown N.P., 34 km WSW of Stanthorpe, 28°47′S, 151°37′E, Sep 1996, *Halford Q2962* (BRI).

Notes: As noted by Armstrong (2002), *Zieria aspalathoides* subsp. *aspalathoides* is widespread (ranging from north Qld to central Victoria) and extremely variable. As with *Z. smithii*, *Z. aspalathoides* is a widespread species with numerous closely related and often locally endemic taxa distributed near and within its range. Further study may well find justification for recognition of more taxa.

Examples of unusual morphological variation can be found in the following collections.

(1) A specimen collected from west of Moura (*Jones 1809*) has stellate indumentum on the branches and the abaxial surface of the leaves. *Z. aspalathoides* normally has an indumentum of simple hairs.

(2) Some small-leaved specimens collected in central Qld (e.g. *Cockburn s.n.* AQ195493) have leaves only slightly larger than *Z. aspalathoides* subsp. *brachyphylla* (see discussion under *Z. aspalathoides*).

(3) As noted by Armstrong (2002) plants from the 'Granite Belt' of south-east Qld and north-east NSW have 'attenuate' [narrowly triangular] sepals. These plants occur with the newly described *Z. graniticola* (see below).

Distribution and habitat: *Zieria aspalathoides* subsp. *aspalathoides* is widespread in eastern Australia from Victoria through NSW, to near Atherton in north Qld (**Map 10**). It occurs in the Brigalow Belt, Einasleigh Uplands and New England Tableland bioregions. The subspecies grows in a wide range of vegetation types, but is usually found in open woodland dominated by eucalypts on a range of substrates such as sandstone, trachyte or granite.

Phenology: Flowers and fruits have been collected from April to January.

Conservation status: Widespread and common in Qld with populations in Blackdown Tableland, Chesterton, Girraween, Isla Gorge, Palmgrove, Precipice and Sundown National Parks. The conservation status can be assessed as **Least Concern** (IUCN 2001).

5b. Zieria aspalathoides subsp. **brachyphylla** J.A.Armstr., *Austral. Syst. Bot.* 15: 317 (2002). **Type:** Queensland. LEICHHARDT DISTRICT: Blackdown Tableland [N.P.], *c.* 35 km SE of Blackwater (campsite at old stockyard on Mimosa Creek) ... *c.* 9.5 km SW of campsite, 23°50'S, 149°00'E, 9 September 1971, *R.J.F.Henderson H1098, L.Durrington & P.R.Sharpe* (holo: BRI; iso: MEL 530477, NSW 458811).

Additional specimen examined: **Queensland.** LEICHHARDT DISTRICT: Plateau above Rockland Spring *c.* 2.2 miles [3.7 km] S of Bluff, Aug 1964, *Gittins 919* (BRI, NSW).

Notes: See discussion under *Z. aspalathoides*.

Distribution and habitat: This subspecies is endemic to Qld where it is restricted to the Blackdown Tableland, south-east of Blackwater within the Brigalow Belt bioregion (**Map 11**). Plants have been recorded as occurring in sandy soil in crevices of sandstone outcrops in eucalypt forest.

Phenology: Flowers and fruit have been collected in August and September.

Conservation status: All known collections of this species were made in Blackdown Tableland N.P. though over a limited area. Known collections were made in 1966 and 1971. Surveys are required to ascertain the number of populations, number of individuals, area of occupancy and perceived threats. A conservation status of **Endangered** is appropriate based on the criteria of B2a,b(i–v) (IUCN 2001). Perceived threats are repeated destruction of populations from uncontrolled wildfires and small population sizes resulting in genetic inbreeding depression.

6. Zieria bifida Duretto & P.I.Forst., **species nova** a *Z. obovata* (C.T.White) J.A.Armstr. caule piloso vestito trichomatibus bifidis (adversum dense hirtos pilis aut simplicibus aut bifidis aut stellatis), petiolis longioribus (3–7 adversum 0–1 mm), margine folioli plus minusve plano (non recurvato), sepalis lanceolatis (adversum elliptico-ovata) et coccis glabris (in illa dense stellato-tomentosis) differens. **Typus:** Queensland. MORETON DISTRICT: Triunia National Park, W of Woombye, 30 January 2000, *A.R.Bean 16002* (holo: BRI; iso: AD, HO 530431 [2 sheets], MEL, NSW).

Zieria sp. (Brolga Park; A.R.Bean 1002); Briggs and Leigh (1996: pp. 170, 290).

Zieria sp. (Brolga Park A.R.Bean 1002); Forster (1997b: 188; 2002: 181; 2007: 183).

***Illustration*:** Logan River Branch SGAP (QLD Region) Inc. (2005: 175) [as *Z.* sp. Brolga Park]

Shrub to 2 m tall forming an open, straggly bush. Stems erect to decumbent, spindly; branches without decurrent leaf bases, weakly glandular verrucose, pilose with mainly bifid hairs. Leaves palmately trifoliolate; petioles 3–7 mm long, pilose; terminal leaflets elliptic, narrow-elliptic or obovate, 7–20 × 3.5–8 mm, laminae weakly pellucid gland dotted, not glandular verrucose, tips acute to obtuse, margins slightly crenulate, thickened, ± flat, midrib not or slightly raised abaxially, secondary veins visible but not raised, adaxial surfaces with few simple hairs along margin, abaxial surfaces with simple or bifid hairs on margin and midrib; lateral leaflets similar to terminal leaflets but smaller, 7–17 × 1.8–7 mm. Inflorescence axillary, 1–several per axil, shorter or same length as subtending leaf, 1–several-flowered, not obviously glandular, sparsely pilose with simple, bifid or trifid hairs; peduncle 4–12 mm long; bracts linear, persistent, 0.4–3.2 mm long; secondary peduncles 1–3 mm long; pedicels 1–3.5 mm long. Sepals lanceolate, 1–2 × 0.7–0.9 mm, valvate in bud, not obviously glandular, tips acute, adaxial surfaces sparsely pilose, abaxial surfaces glabrous apart from minutely pilose margins. Petals lanceolate-elliptic, 1.8–2 × 0.8–1 mm, white, valvate in bud, not obviously glandular, adaxial surface glabrous apart from scattered stellate and bifid hairs near margin, abaxial surfaces with scattered to sparse bifid and stellate hairs along margins and especially near tip. Staminal filaments *c.* 0.8 mm long, with occasional bifid hair, eglandular; anthers *c.* 0.4 mm long, apiculum absent. Gynoecium glabrous. Cocci 2–3 × 1–1.5 mm, not glandular verrucose, glabrous, base of style sometimes persistent forming a minute apical apiculum. Seeds oblong-ovoid, 0.7–1.2 × 1–1.25 mm, black to black-purple, dull, longitudinally striated. **Fig. 3.**

***Additional specimens examined*:** **Queensland.** MORETON DISTRICT: Brolga Park, beside Dulong road, W of Woombye [Triunia N.P.], Jan 1989, *Bean 996* (BRI); *loc. cit.*, Feb 1989, *Bean 1002* (BRI); *loc. cit.*, Dec 1989, *Bean 1193* (BRI); *loc. cit.*, Apr 1990, *Bean 1465* (BRI, MEL); Blackall Range, Brolga Environmental Park [Triunia N.P.], *c.* 6 km WNW of Nambour, Feb 1990, *Davies 1540 & Richardson* (BRI, MEL); Towen Mount road, Nambour, Jul 2003, *Moran s.n.* (BRI [AQ778097]).

***Notes*:** *Zieria bifida* is somewhat of an enigma as to its relationships, with possible morphological affinities to both *Z. exsul* and *Z. obovata*; *Z. obovata* being markedly, geographically disjunct. This new species is rather weakly formed in habit and is somewhat unusual in the predominantly bifid hairs of the indumentum. *Z. bifida* differs from *Z. obovata* in the pilose stems with bifid trichomes (versus dense-shaggy, stellate-tomentose), longer petioles (3–7 mm versus 0–1 mm), leaflet margins not recurved (versus recurved), lanceolate sepals (versus elliptic-ovate) and glabrous cocci (versus densely stellate-tomentose). *Z. exsul* differs from *Z. bifida* in the shorter petioles (2–3 versus 3–7 mm), the leaflets being densely stellate-tomentose below (versus glabrous) and with recurved to revolute margins (versus flat) and a raised midrib (versus flat or nearly so).

***Distribution and habitat*:** *Zieria bifida* is endemic to Qld and is currently known only from two localities near Nambour within the Southeast Queensland bioregion: Triunia N.P. (formerly Brolga Park) and Towen Mount road (**Map 10**). The species is found in the ecotone of rainforest (complex notophyll vineforest) and open forest of *Eucalyptus propinqua, Corymbia intermedia* and *Lophostemon confertus* on loamy soil overlying metasediments.

***Phenology*:** Flowers and fruit have been collected from December to April.

***Conservation status*:** The type locality of *Zieria bifida* is within a National Park; however, its habitat is small and under threat from fires and weed species such as *Lantana camara.* Less than 1000 plants are thought to be present with an area of occupancy less than 2 ha (A.R.Bean pers. comm. 2002). At Towen Mount road there are reputed to be 100's of

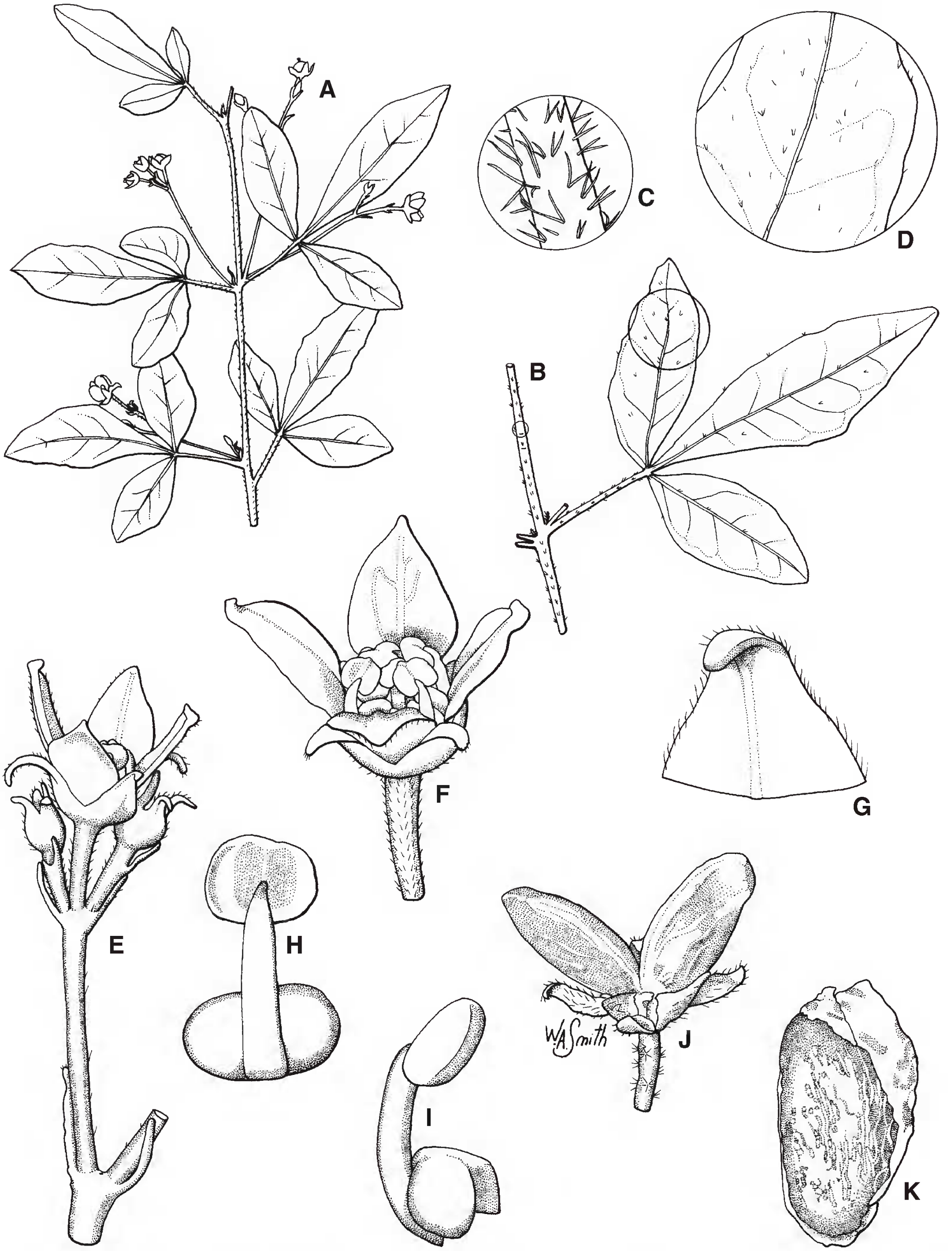


Fig. 3. ***Zieria bifida.*** A. branch with several flowering inflorescences × 1.5. B. stem node with abaxial view of leaf × 2. C. detail of indumentum on stem × 16. D. detail of indumentum on abaxial surface of leaf × 6. E. inflorescence with flower and calyces × 6. F. flower × 12. G. tip of sepal × 30. H–I. views of stamens × 30. J. mature fruit with multiple cocci × 8. K. lateral view of seed × 16. All from *Bean 16002* (BRI). Del. W. Smith.

plants (A.R.Bean pers. comm. 2006). As this species is restricted to the ecotone, then the available habitat is small and subject to rapid change from fire or the expansion of the adjacent vegetation. This species is listed as **Endangered** in Qld (*NCA* 1994).

***Etymology*:** Named for the bifid hairs that beset much of the foliage.

7. Zieria boolbunda Duretto & P.I.Forst., **species nova** a *Z. montana* J.A.Armstr. ramis manifeste glandulari-verrucosis (adversum ramos laeves) indumentum sparsum (adversum glabrum) ferentibus et floribus usque ad 7 (non 10–20+) in quaque inflorescentia differt. **Typus:** Queensland. BURNETT DISTRICT: 1.5 km SSW of Boolbunda Rock, 25°08′S, 151°42′E, 15 May 1986, *P.I.Forster PIF2441* (holo: BRI; iso: CANB 383722, K, MEL 1582511).

Shrub to 1 m tall forming a densely compact bush. Stems erect, wiry; branches with prominent decurrent leaf bases, glandular verrucose, with a sparse indumentum of mainly stellate hairs between decurrent leaf bases, otherwise glabrous. Leaves palmately trifoliolate; petioles 5–10 mm long, slightly glandular verrucose, adaxial surfaces with simple hairs along midrib, abaxial surfaces glabrous or glabrescent; terminal leaflets elliptic to slightly obovate, 11–25 × 3.5–8 mm, laminae slightly glandular verrucose, margins entire, flat or slightly recurved (sometimes revolute on drying), midribs raised abaxially, slightly glandular verrucose, secondary veins not raised abaxially, usually obscure, tips acute and slightly mucronate, adaxial surfaces with few hairs along midrib, abaxial surfaces glabrous or stellate glabrescent; lateral leaflets similar to terminal leaflets though usually smaller, 10–22 × 2–8 mm. Inflorescence axillary, shorter than or nearly equal to subtending leaf, usually 7-flowered though only 1–3 flowers open at any time; peduncle 4–15 mm long, slightly glandular verrucose, with a sparse stellate indumentum; bracts leaf like, persistent, to 2 mm long, glabrescent; pedicels 2.5–3 mm long, with a sparse stellate indumentum. Sepals deltate, *c.* 1.5 × 1 mm, valvate in bud, not or slightly glandular verrucose, tips acute to slightly acuminate, adaxial surfaces with scattered appressed simple hairs, abaxial surfaces glabrous or few hairs at base. Petals elliptic, *c.* 2.5 × 1.2–1.5 mm, pink-cream, dotted with pellucid glands, adaxial surfaces with a sparse to dense stellate indumentum, abaxial surfaces sparsely stellate pubescent, denser along margins. Staminal filaments *c.* 1.5 mm long, glabrous, slightly glandular or not at tip; anthers *c.* 0.6 mm long, apiculum absent. Gynoecium glabrous. Cocci *c.* 3 × 2 mm, smooth or slightly glandular verrucose, glabrous, base of style not persistent. Seeds oblong-ovoid, 2.5–2.6 × 1–1.25 mm, black, longitudinally striate. **Fig. 4.**

***Additional specimens examined*:** BURNETT DISTRICT: Summit of Boolbunda Rock, near Mt Perry, Aug 1986, *Bean 477* (BRI); Boolbunda Rock, *c.* 9 km NE of Mt Perry township, 25°07′S, 151°42′E, Oct 1995, *Sparshott KMS616 & Sparshott* (BRI).

***Notes*:** *Zieria boolbunda* can be distinguished from *Z. montana* by the branches being glandular verrucose (versus smooth), having a sparse indumentum (versus glabrous) and up to 7 flowers per inflorescence (versus 10–20+), and from *Z. smithii* by the prominently raised decurrent leaf bases (versus absent or very faint).

***Distribution and ecology*:** *Zieria boolbunda* is endemic to Qld and known only from Boolbunda Rock and surrounds north-east of the Mt Perry township within the Southeast Queensland bioregion (**Map 12**). It is found in clefts and crevices of granite outcrops under tall, open woodland of *Eucalyptus montivaga* with a shrubby understorey or in mountain heath with *Leptospermum*, *Alyxia* and *Lomandra* at altitudes between 600–680 m.

***Phenology*:** Flowers and fruit have been collected in May.

***Conservation status*:** This species can be locally common; however, it has a highly restricted distribution with no populations in conservation reserves. It can be assessed as **Vulnerable** on the criterion D2 (IUCN 2001). Surveys are required to ascertain the number of populations, number of individuals, the area of occupancy and any perceived threats.

***Etymology*:** The specific epithet refers to the picturesque and imposing rock this species appears to be restricted to.

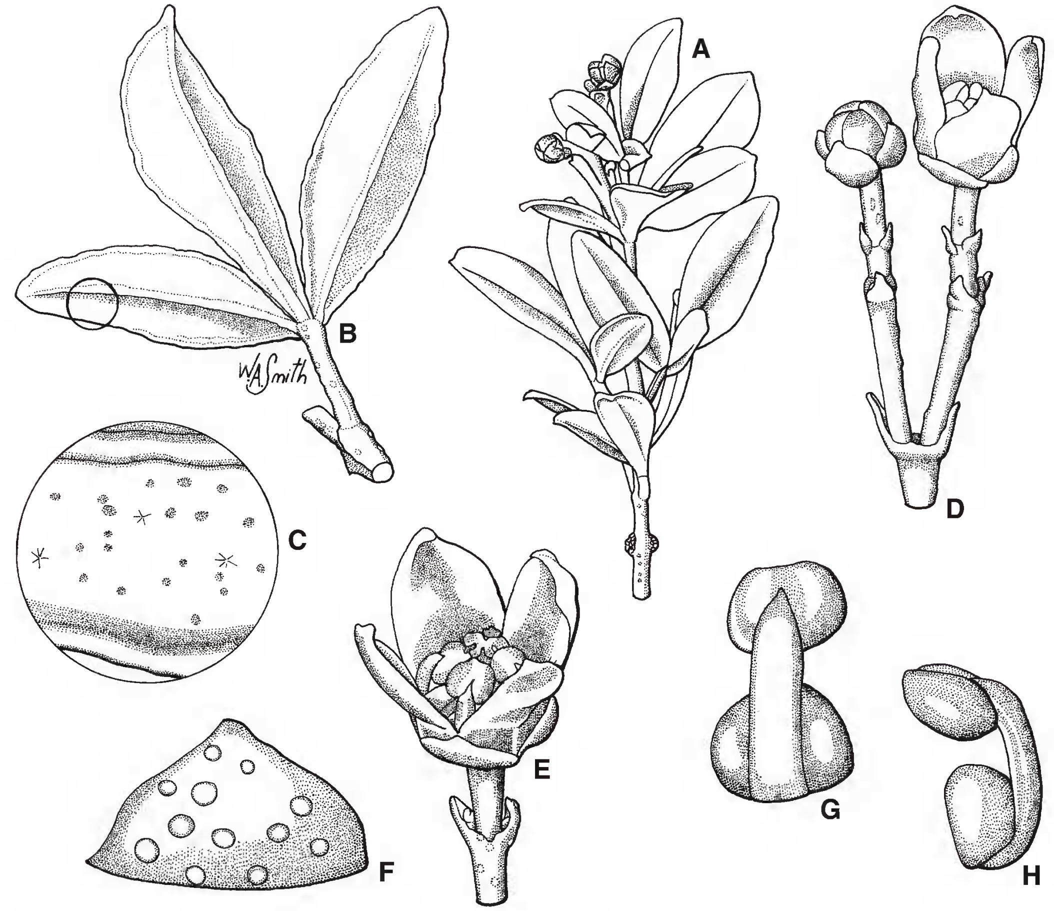


Fig. 4. ***Zieria boolbunda.*** A. branch with several budding inflorescences × 1.5. B. stem node with abaxial view of leaf × 3. C. detail of indumentum on abaxial surface of leaflet × 16. D. inflorescence with flower and bud × 6. E. flower × 8. F. tip of sepal × 20. G–H. views of stamens × 20. All from *Forster PIF2441* (BRI). Del. W. Smith.

8. Zieria cephalophila Duretto & P.I.Forst., **species nova** a *Z. compacta* C.T.White e *Z. fraseri* Hook. ramis glandulari-verrucosis (non glabris) et sparse tomentosis (adversum plerumque dense pilosos); foliis parvis glandulari-verrucosis (non glabris) foliolis stellatis glabrescentibus vel indumento sparso stellato in pagina abaxiali (adversum glabrum vel sparse pilosum) praeditis, et venis secundariis in pagina abaxiali non manifeste elevatis (adversum manifeste vel parum elevatas) differt. **Typus:** Queensland. Leichhardt District: Sydney Heads, 32 km NNW of Nebo, 21°25′S, 148°35′E, 11 November 1990, *A.R.Bean 2562* (holo: BRI).

Zieria sp. (Sydney Heads A.R.Bean 2562); Forster (2007: 183).

Shrub to 50 cm tall, forming an open compact bush. Stems erect, wiry; branches without or with slight decurrent leaf bases, prominently glandular verrucose, with a sparse indumentum of stellate hairs between the glands that is denser between the decurrent leaf bases, soon becoming glabrescent with age. Leaves palmately trifoliolate; petioles 2–3 mm long, glandular verrucose, with scattered stellate hairs; terminal leaflets narrow elliptic to narrow obovate, 11–18 × 1.5–3.5 mm, tips acute, margins revolute, midrib strongly raised abaxially and glandular verrucose, secondary veins not or weakly raised abaxially, adaxial surfaces slightly glandular verrucose, stellate glabrescent or with a sparse stellate indumentum, abaxial surfaces not glandular verrucose, densely stellate-tomentose though not or sparingly so on midvein; lateral leaflets similar to terminal leaflets but slightly smaller. Inflorescence axillary, shorter than the subtending leaf, 1–3-flowered, glandular verrucose, with a sparse stellate indumentum; peduncle 1.5–6 mm long; bracts scale like, persistent, 0.5–1.5 mm long; pedicels 1–2.2 mm long, not or slightly glandular verrucose, sparsely to moderately-densely stellate tomentose. Sepals deltate, 1–1.5 mm long and wide, imbricate in bud, slightly glandular verrucose, tips acute, adaxial surfaces with scattered appressed simple hairs, abaxial surfaces with a moderately dense indumentum of stellate hairs. Petals narrow-elliptic, *c.* 3.5 mm long, white, aestivation unknown, not obviously glandular, both surfaces densely stellate-tomentose. Staminal filaments 0.8–1.3 mm long, glabrous or with few hairs near tip, very weakly glandular verrucose near tip; anthers *c.* 0.5 mm long, apiculum absent. Gynoecium glabrous. Cocci *c.* 2.5 × 1.5 mm, smooth, glabrous and slightly glaucous. Seeds not observed. **Fig. 5.**

***Additional specimen examined*:** LEICHHARDT DISTRICT: SE edge of Sydney Heads, Britton Range, 6.3 km NE/ENE of Homevale Homestead [Homevale N.P.], 21°25′S, 148°35′E, May 2003, *Kemp TH7339* (BRI).

***Notes*:** *Zieria cephalophila* appears to be affiliated with *Z. compacta* and *Z. fraseri*

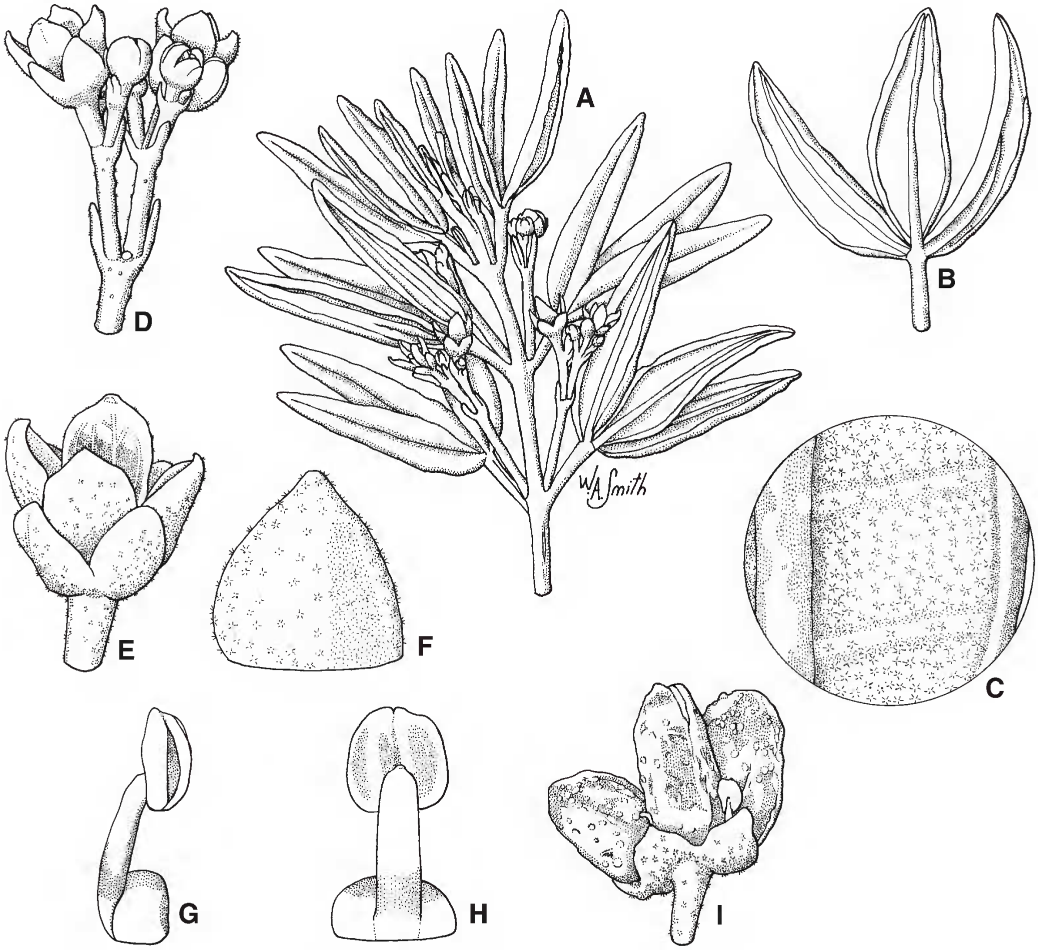


Fig. 5. ***Zieria cephalophila.*** A. branch with several budding and flowering inflorescences × 1.5. B. abaxial view of leaf × 2. C. detail of indumentum on abaxial surface of leaflet × 12. D. inflorescence with flowers and buds × 4. E. flower × 8. F. tip of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. A–H from *Kemp TH7339* (BRI); I from *Bean 2562* (BRI). Del. W. Smith.

but differs from these by the branches that are glandular verrucose (versus smooth) and sparsely tomentose (versus usually densely hairy), the leaves that are small and glandular verrucose (versus smooth), leaflets that are stellate glabrescent, or have a sparse stellate indumentum on the adaxial surface (versus glabrous or sparsely pilose), and secondary veins that are not noticeably raised on the abaxial surfaces (versus prominently or slightly raised). Like *Z. fraseri* it has leaflets with acute tips and the midvein on the abaxial surface is not densely stellate tomentose.

Distribution and habitat: *Zieria cephalophila* is known from two collections made from Sydney Heads, near Nebo (**Map 6**). These specimens were collected on a rocky mountain top (tertiary acid volcanic plateau – collectors notes with *Kemp TH7339*) where it was growing in a community of *Leucopogon neoanglicus*, *Cassia* sp. and *Lophostemon confertus*, or a shrubland of *Leptospermum ?polygalifolium*, *Acacia aulacocarpa* and *Lophostemon confertus*.

Phenology: Flowers and fruit have been collected in May and November.

Conservation status: On the basis of the restricted distribution alone, this species can be assessed as **Vulnerable** on the criterion D2 (IUCN 2001). Populations occur within Homevale N.P.

Etymology: The specific epithet is derived from the Greek *cephalus* (head) and *philus* (loving) and alludes to the populations of this plant occurring on Sydney Heads.

9. Zieria collina C.T.White, *Proc. Roy. Soc. Queensland* 43: 46/47 (1932). **Type:** Queensland. Moreton District Tamborine Mountain, 11 August 1929, *C.T.White 6155* (holo: BRI).

Illustrations: Hauser & Blok (1998: 367); Armstrong (2002: 336, 337); Logan River Branch SGAP (QLD Region) Inc. (2002: 328).

Correction to description given in Armstrong (2002): Petals 1.2–2 mm long.

Additional specimens examined: **Queensland.** Moreton District: Hayes road off Oxenford – Tamborine road, Wongawallan, 27°53′S, 153°12′E, Oct 2001, *Halford Q7044* (BRI, HO); 0.3 km past Panorama Point, Mt Tamborine, 27°54′S, 153°12′E, Jul 1999, *Bean 15234* (BRI, MEL); Wongawallan road, near Panorama Point Lookout, 27°54′S, 153°13′E, Oct 2001, *Halford Q7041 et al.* (BRI, MEL, NSW); North Tamborine Council Reserve, E end of Hartley road, 27°56′S, 153°11′E, Mar 1997, *Fitzsimmons s.n.* (BRI [AQ653204]); Mt Tamborine golf course, Mt Tamborine, 27°58′S, 153°12′E, Oct 2001, *Halford Q7043* (AD, BRI); Maybury Gully area, Canungra land Warfare Centre, 27°59′S, 153°13′E, May 1997, *Hauser s.n.* (BRI [AQ654965]); Contour road, Mt Tamborine, Mar 1976, *Sharpe 1996 & Reynolds* (BRI).

Typification: Armstrong (2002) cites both *White 6155* and *White 61555* as the type collection for this name. The correct number is *White 6155*.

Notes: Allied or similar appearing species are *Zieria exsul* and *Z. tenuis* (see notes there).

Distribution and habitat: This species is endemic to Qld where it is restricted to Mt Tamborine and surrounds within the Southeast Queensland bioregion (**Map 11**) where it occurs in the transitional zone between ‘wet’ open forest and rainforest, on substrates derived from basalt or metasediments. Armstrong (2002) stated that the species was “confined to the steep narrow gulleys [sic] in Cedar Creek, Palm Grove and The Knoll National Parks on Tambourine [sic] Mountain”. As predicted by Armstrong, this species has been now found in other localities, the most notable being the Canungra land Warfare Centre, which is somewhat disjunct to the main area of distribution around Mt Tamborine.

Phenology: Flowers have been collected from (April) July to October (December), and fruit in December (Armstrong 2002).

Conservation status: *Zieria collina* is currently listed as **Vulnerable** in Qld (*NCA* 1994). It is locally common in several populations on and near to Mt Tamborine in south-east Qld. Fitzsimmons (1999) found that the species is threatened from human-induced habitat loss and fragmentation, has restricted seed dispersal and that populations are subject to weed invasion, particularly from *Lantana camara*. The abundance of this species appears to be related to site disturbance as Fitzsimmons (1999) also found that great numbers of seedlings appeared after one of her study sites was damaged by a bulldozer. The species is present in Mt Tamborine N.P. and Clagiraba Conservation Area.

10. Zieria compacta C.T.White, *Proc. Roy. Soc. Queensland* 53: 209 (1942); *Zieria compacta* var. *compacta* C.T.White, *loc. cit* (1942); *Zieria fraseri* subsp. *compacta* (C.T.White) J.A.Armstr., *Austral. Syst. Bot.* 15: 355 (2002). **Type:** Queensland. Darling Downs District: Messines, near Stanthorpe (ex Brisbane Wild Flower Show), 13 September 1930, *C.E.Hubbard 3965* (holo: BRI).

***Illustrations*:** Armstrong (2002: 356) [as *Z. fraseri* subsp. *compacta*]; Logan River Branch SGAP (QLD Region) Inc. (2005: 174) [as *Z. fraseri*].

Shrub to 2 m tall forming a densely compact bush. Stems erect, wiry; branches without decurrent leaf bases, not obviously glandular, with a dense indumentum of mainly stellate hairs but simple and bifid hairs also present. Leaves palmately trifoliolate, not obviously glandular; petioles 3–8 mm long, with a dense indumentum of simple and stellate hairs; terminal leaflets elliptic to obovate, 11–32 × 3.5–10 mm, tips obtuse to acute, minutely apiculate, margins flat to recurved (sometimes revolute on drying), midribs strongly raised abaxially, secondary veins weakly raised abaxially, adaxial surfaces mainly glabrous with scattered simple hairs along margins and midrib or sparsely pilose all over (Bull Creek Gorge), abaxial surfaces densely stellate-tomentose including on midrib, often with scattered long simple hairs, especially along midribs; lateral leaflets similar to terminal leaflets but smaller, 8–26 × 2–9 mm. Inflorescence axillary, usually shorter than the subtending leaf (but not always), 3–20+-flowered, not obviously glandular, with a sparse to dense indumentum of simple, bifid and stellate hairs; peduncle 5–18 mm long; bracts lanceolate, often leaf-like, persistent, 1–5.5 mm long; secondary peduncles 1–10 mm long; pedicels 2–6 mm long, not obviously glandular, with a sparse to dense stellate indumentum. Sepals ovate-triangular, 1–2 × 0.8–2 mm, slightly imbricate in bud, not obviously glandular, tips acute and usually slightly inflexed, adaxial surfaces ± glabrous or with scattered simple, bifid and stellate hairs towards tip, abaxial surfaces with a sparse to moderately dense indumentum of stellate and sometimes also simple hairs, evenly spread over entire surface or only at base. Petals elliptic, 3.5–5 × 1.2–3.3 mm, white or white-pink, often drying pink, imbricate in bud, not obviously glandular, adaxial surfaces with a sparse indumentum of simple and stellate hairs, abaxial surfaces densely stellate-tomentose. Staminal filaments 1.1–1.4 mm long, glabrous or with few hairs, weakly glandular verrucose at tip; anthers *c.* 0.7 mm long, apiculum absent. Gynoecium glabrous apart from sparse to dense stellate indumentum on the inner edge. Cocci 3.5–4 × 2–2.8 mm, not glandular verrucose, with a sparse stellate indumentum on the inner edge only or all over, base of style persistent forming a minute apical apiculum. Seeds oblong-ovoid, 2.5–2.8 × 1.5–1.8 mm, brown-black, dull though striations shiny, longitudinally striate.

***Additional selected specimens examined*: Queensland.** Leichhardt District: Bull Creek Gorge area, near 'Castlevale', 24°33′S, 146°42′E, Sep 1984, *O'Keeffe 655* (BRI); Bull Creek Gorge, S of Springsure – Tambo road, 24°34′S, 146°46′E, Sep 1999, *Bean 15383* (BRI, MEL, NSW); Carnarvon N.P., Mt Playfair road, 24°47′S, 146°58′E, Sep 2000, *Copeland 2674 et al.* (BRI; ex NE); Expedition N.P., NW of Taroom, Glenhaughton Gorge, 25°11′S, 149°09′E, Sep 1999, *Forster PIF24791 et al.* (AD, BRI, MEL); Expedition N.P., NW of Taroom, Spring Creek, 25°15′S, 149°08′E, Sep 2000, *Forster PIF26127 et al.* (AD, BRI, HO, MEL, NSW); Robinson Gorge N.P. [now Expedition N.P.], in Get Down section, 25°18′S, 149°10′E, Sep 1992, *Forster PIF11266 & Sharpe* (BRI); Robinson Gorge N.P. [now Expedition N.P.], in Get Down area, 25°18'S, 149°10'E, Sep 1992, *Forster PIF11399 & Sharpe* (BRI, MEL, NSW); Near Get Down, Robinson Gorge, Expedition N.P., 25°18′S, 149°10′E, Sep 1995, *Forster PIF17733 & Figg* (BRI, MEL, NSW). Wide Bay District: Fraser Island [unlocalised], Jun 1965, *Jones s.n.* (CANB 189291). Darling Downs District: 'Sow and Pigs', Amiens, via Stanthorpe, 28°35′S, 151°48′E, Aug 1983, *Harslett s.n.* (BRI [AQ349636], CANB); 15.7 km SW of Stanthorpe, Portion 87, Stalling lane, 28°44′S, 151°48′E, Nov 1994, *Halford Q2323* (BRI, MEL); Portion 90, Wyberba, near Girraween N.P., 28°50′S, 151°54′E, Sep 1993, *Bean 6396 & Forster* (BRI, CANB); Bald Rock Creek, Girraween N.P., 28°50′S, 151°57′E, Jun 1994, *Grimshaw PG813 & Halford* (BRI); Castle Rock, Girraween N.P., 28°51′S, 151°56′E, Sep 1993, *Bean 6339* (BRI); Ridge of Bald Mt, extreme W section of Girraween N.P., 28°52′S, 151°54′E, Sep 1994, *Grimshaw PG973 & Turpin* (BRI, NSW); Christie Target, 10 km due W of Wallangarra, 28°55′S, 151°49′E, Dec 1989, *Bean 1240* (BRI, CANB, MEL); Bald Rock Creek, near The Cascades, *c.* 10 km N of Wallangarra, 28°55′S, 151°56′E, Sep 1988, *Telford 10695* (BRI, CANB). Moreton District: Hartmann Park, Crows Nest, 27°15′S, 152°03′E, Oct 1994, *Bean 7946* (BRI); Bungaree Environmental Park, 2 km ENE of Crow's Nest, 27°15′S, 152°04′E, Sep 1992, *Halford*

Q1501 (BRI, MEL); Helidon Hills, north of Paradise Creek, 27°26′S, 152°06′E, Sep 1993, *Sparshott 109 & Sparshott* (BRI).

***Typification*:** Armstrong (2002) did not cite a collector's number for the *Hubbard* type of *Zieria compacta* at BRI, following on from White (1942). As far as we can tell, all of Hubbard's collections that he made in Qld are numbered and it is clearly indicated on the type sheet as *Hubbard 3965*.

***Notes*:** Armstrong (2002) relegated this taxon to subspecific rank under *Zieria fraseri* and distinguished the subspecies on a number of characters. To partially reiterate Armstrong, in *Z. fraseri* he considered the central leaflets to be narrowly elliptic to narrowly obovate, the calyx lobes broadly triangular to deltate, glabrous and not noticeably inflexed adaxially at the apex, the style glabrous, the stigma not noticeably lobed and the fruit glabrous. In *Z. compacta* the central leaflets are elliptic to obovate, the calyx lobes are ovate to triangular, hirsute with stellate hairs and inflexed adaxially at the apex, the style has scattered stellate hairs, the stigma is noticeably lobed and the fruit is hirsute on the adaxial margins of cocci. Of these characters only the leaflet shape, sepal tip (though often difficult to see) and the indumentum of the cocci are useful: the other characters do not differ consistently. Despite this, there are characters that readily separate the taxa. In *Z. fraseri,* the leaflets are narrow-elliptic to narrow-obovate with recurved to revolute margins and subulate to acute tips, the midrib of the abaxial surface of the leaflets is glabrous or with an indumentum markedly less dense than that of the lamina, the pedicel is glabrous or with a sparse indumentum, the sepal tip is slightly acuminate and not inflexed, and the cocci are glabrous. In *Z. compacta* the leaflets are elliptic to obovate with a flat to recurved margin and a subacute to rounded tip, the midrib of the abaxial surface of the leaflets has an indumentum as, or nearly as dense as that of the lamina, the pedicel has a sparse to dense indumentum, the tips of the sepals are acute and inflexed (often difficult to see), and the cocci are hirsute, if only on the adaxial margin.

The two taxa do not appear to intergrade and the character differences between them justify resurrecting *Zieria compacta* at specific level, necessitating a description. *Z. compacta* is considered to be most closely allied to *Z. fraseri* (in this paper with two subspecies) and the narrowly distributed *Z. exsul* (see notes under that species).

Specimens from Bull Creek Gorge differ from the remaining specimens by being sparsely pilose all over the adaxial surface of the leaflets (versus mainly glabrous with scattered simple hairs along margins and midrib).

***Distribution and habitat*:** Armstrong (2002) provides conflicting evidence about the distribution of this taxon in Qld. In his Fig. 51 he maps it (as *Z. fraseri* subsp. *compacta*) north to the Darling Downs and Fraser Island in Wide Bay. In his notes he firstly states "from the Darling Downs District in south-eastern Queensland south to the South West Slopes of south-central NSW", then secondly "on Fraser Island it occurs in sandy areas and at Ward's Canyon, in the Carnarvon Gorge National Park", then thirdly "taxon often co-occurs with *Z. cytisoides* [e.g. in the Carnarvon Gorge National Park…".

We consider this species to be widespread in Qld within the Brigalow Belt, Southeast Queensland and New England Tableland bioregions (**Map 11**). There is a northern record from Bull Creek Gorge and populations near Crows Nest and Helidon and in the 'Granite Belt'. We have sighted one collection purported to be from Fraser Island (*Jones s.n.* [CANB 189291]); however, this record requires field confirmation. *Z. compacta* is also widespread in NSW (Armstrong 2002; Armstrong & Harden 2002).

This species usually occurs in open eucalypt forest or woodland in sandy soils over sandstone or granite, often in sheltered situations such as the base of cliffs and in gullies. At Bull Creek Gorge it is found with *Eucalyptus cloeziana, E. decorticans* and *Angophora leiocarpa.* At Expedition N.P. it is found in woodland associated with *E. cloeziana, E. mediocris, Corymbia watsoniana, C. citriodora* and

Syncarpia glomulifera. Near Crows Nest it is found with *E. montivaga, E. resinifera* and *Angophora woodsiana*. Around Girraween N.P. *Z. compacta* is found in low open forest and shrubland of *E. andrewsii, E. prava, E. youmanii* and *Allocasuarina littoralis*. In the Granite Belt the species is also found in heathland.

Phenology: Flowers have been collected between August and October, and fruit in June and between September and December.

Conservation status: In Qld this species is common and widespread and it is present in various conservation areas, *viz*. Carnarvon, Expedition and Girraween National Parks, and Bungaree Conservation Park. A conservation status of **Least Concern** (IUCN 2001) is recommended.

11. Zieria cytisoides Sm. in Rees, *Cyclo.* 39: no. 4 (1818). **Type**: New South Wales, 1805, *Earl St Vincent* (holo: LINN [J.E.Smith Herbarium] 214.4 [images BRI, HO 534653]).

Illustrations: Armstrong (2002: 343, 344).

***Additional selected specimens examined*: Queensland.** Cook District: Mt Emerald, 17°12′S, 145°24′E, Mar 2000, *Holmes 177* (BRI, QRS). South Kennedy District: Mt Jukes N.P., *c*. 30 km NW of Mackay, 21°00′S, 148°57′E, May 1991, *Bean 3182* (BRI, CANB, NSW). Maranoa District: Slopes of Junction Ridge, N of Marlong Arch, Mt Moffatt [Carnarvon] N.P, via Injune, 24°58′S, 147°54′E, Oct 1998, *Bean 14309* (BRI, MEL, NSW). Leichhardt District: Just below the summit of Ropers Peak, NE of Capella, 22°52′S, 148°13′E, Aug 1987, *Bean 629* (BRI); Ralph's Big Rock, S.F. 34, Ruined Castle Creek catchment, NW of Taroom, 25°05′S, 149°11′E, Nov 1998, *Forster PIF23937 et al*. (BRI, MEL, NSW); Robinson Gorge N.P. [now Expedition N.P.], western base of Shepherds Peak along track to Cattle Dip, 25°19′S, 149°11′E, Sep 1992, *Forster PIF11443 & Sharpe* (BRI, MEL). Burnett District: 3 km W of 'Toondahra' Homestead, Mt Lorna, 25°59′S, 151°21′E, Aug 1988, *Forster PIF4638* (BRI, CANB, K, MO); Beeron Holding, 25°59′S, 151°21′E, Sep 1999, *Duretto 1328 et al*. (BRI, MEL); Boondooma Dam, W of Proston, 26°06′S, 151°26′E, Nov 1996, *Bean 11372* (BRI); Coomba Falls, 2 km E of Maidenwell, 26°51′S, 151°48′E, Sep 1996, *Smyrell s.n.* (BRI [AQ650117]). Darling Downs District: Johnson's Mt, 8 km from Swanfels, 33.5 km E of Warwick, 28°12′S, 152°15′E, Aug 1992, *Ballingall 2728* (BRI); Portion 90, Tartini Pty Ltd, 10.5 km NW of Ballandean, 28°45′S, 151°45′E, Dec 1994, *Halford Q2360* (BRI, NSW); Mt Jibbinbar, Sundown N.P., 34 km WSW of Stanthorpe, 28°47′S, 151°37′E, Sep 1996, *Halford Q2939* (BRI). Moreton District: E of 'Fair Hills', SW of Cooyar, 27°03′S, 151°44′E, Aug 1996, *Bean 10593* (BRI, MEL, NSW).

Notes: This is a variable species in leaf morphology and indumentum density, and further critical study may result in the recognition of additional taxa. The consistent uniting characters for the species are the large pink flowers, the downy or shaggy indumentum on the foliage and the prominently raised secondary venation on the abaxial surfaces of the leaflets.

Distribution and habitat: *Zieria cytisoides* occurs from Victoria through NSW into inland southern Qld in a series of closely distributed populations to a northern limit at Ropers Peak near Capella. There are also disjunct northern occurrences at Mt Jukes north of Mackay and Mt Emerald near Atherton. It is present within the Brigalow Belt, New England Tableland and Southeast Queensland bioregions (**Map 8**). It is much more widespread in Qld than indicated by Armstrong (2002). *Z. cytisoides* grows in skeletal soils derived from granite, sandstone or trachyte substrates in open eucalypt woodland, shrubland or heathland. Associated canopy species in the open woodland may include *Angophora leiocarpa, Corymbia citriodora, C. hendersonii, C. watsoniana, Eucalyptus cloeziana, E. decorticans* and *Lysicarpus angustifolius*.

Phenology: Flowers have been collected from August to October and in March, and fruit from October to December and in March and May.

Conservation status: This species is common and widespread and is present in several National Parks, including Carnarvon, Expedition, Mt Jukes and Sundown. A conservation status of **Least Concern** (IUCN 2001) is recommended.

12. Zieria distans Duretto & P.I.Forst., **species nova** *Z. verrucosae* J.A.Armstr. affinis sed foliolis multo minoribus aut patentibus aut erectis (non cernuis) et anguste ellipticis (non linearibus) ratione longitudinis latitudini minore (3.6–10.1 adversum 10–25.3), inflorescentiae bracteis linearibus (adversum anguste oblongas) et sepalis dense (non dispersis) glandulari-verrucosis differt. **Typus:** Queensland. Burnett District: Mt Walla, Walla Range, 5 km SW of Coalstoun Lakes, 12 September 2002, *P.I.Forster*

PIF28835 (holo: BRI [2 sheets + spirit]; iso: A, AD, HO 530418 [3 sheets], L, MEL, NSW, NY, Z distribuendi).

Shrub to 1.5 m tall forming an open, straggly bush. Stems erect, wiry; branches without decurrent leaf bases, glandular verrucose, densely stellate-tomentose on very young branches only, otherwise glabrescent or glabrous. Leaves palmately trifoliolate; petioles 5–12 × 0.6–0.7 mm, glandular verrucose, minutely pilose or glabrous; terminal leaflets narrow-elliptic, (8–) 11–30 (–37) × 1–4.5 mm, laminae weakly glandular verrucose on adaxial surfaces, margins and abaxial midribs, tips obtuse to acute, margins entire and slightly recurved, sometimes becoming revolute on drying, midribs raised abaxially, secondary veins obscure, adaxial surfaces glabrous except for a few simple or stellate hairs along midrib and near base, abaxial surfaces densely stellate tomentose except for midribs; lateral leaflets similar to terminal leaflets and may be larger or smaller; leaflet length/width ratio 3.6–10.1. Inflorescence axillary, shorter than the subtending leaf, 12–21+-flowered, glandular verrucose apart from flowers, with a scattered to dense indumentum of simple and stellate hairs; peduncle 2–8 mm long; bracts linear, persistent, 0.5–1.5 (–3.5 Mt Roberts & Walla Range) mm long; secondary peduncles 2–4 mm long; pedicels 1–2.5 mm long, weakly glandular verrucose, densely stellate-tomentose. Sepals ovate-triangular, 1–1.2 × 0.5–0.8 mm, imbricate in bud, glandular verrucose, tips acute, adaxial surfaces glabrescent, abaxial surfaces densely stellate-tomentose at base, otherwise glabrescent between glands. Petals elliptic, 1.8–3 × 1–1.5 mm, white, imbricate in bud, not obviously glandular, tips acute, adaxial and abaxial surfaces stellate tomentose. Staminal filaments *c.* 1 mm long, glabrous or with few scattered minute hairs, eglandular; anthers *c.* 0.5 mm long, apiculum absent. Gynoecium glabrous. Cocci *c.* 3.5 × 0.5 mm, not or slightly glandular verrucose, glabrous, base of style persistent forming a minute apical apiculum. Seeds not observed. **Fig. 6.**

***Additional specimens examined*: Queensland.** PORT CURTIS DISTRICT: *c.* 9 km NE of Miriam Vale, Westwood Range [Eurimbula N.P.], 24°16′S, 151°37′E, Jul 1996, *Thompson MIR173 & Price* (BRI); Kroombit Tops N.P., western section, 24°21′S, 150°52′E, Aug 1995, *Thompson BIL132 & Turpin* (BRI, MEL); Kroombit Tops N.P., western section, 24°25′S, 150°53′E, Aug 1995, *Thompson BIL105 & Turpin* (BRI); Kroombit Tops N.P., western section, 24°27′S, 150°54′E, Aug 1995, *Thompson BK140 & Manders* (BRI); Kroombit Tops N.P., 24°27′S, 150°59′E, Dec 1996, *Brushe JB672* (BRI); T.R. 353, Mt Roberts, 24°30′S, 151°16′E, *Thompson MON1 & Turpin*, Jul 1995 (BRI, HO). BURNETT DISTRICT: western slope of Walla Range, 25°38′S, 151°50′E, Jun 1996, *Grimshaw PG2460 & Turpin* (BRI); 3 km SW of Coalstoun Lakes, Walla Range, 25°38′S, 151°51′E, Aug 1990, *Randall 611* (BRI); Coalstoun Lakes shop [actually Walla Range], 25°39′S, 151°50′E, Jun 1994, *Thomas 320 & Sinclair* (BRI); Coongara Rock, N face near summit, 25°39′S, 151°58′E, May 1996, *Grimshaw PG2396 & Baumgartner* (BRI, CANB); Southern base of Coongara Rock, 11 km ESE of Coalstoun Lakes, 25°39′S, 151°59′E, Sep 2002, *Forster PIF28843* (BRI, HO, MEL, NE, NSW); Coongara Rock, 11 km ESE of Coalstoun Lakes Township, 25°39′S, 151°58′E, Nov 2002, *Forster PIF29104* (BRI); *loc. cit.*, Dec 2002, *Forster PIF29192* (BRI, MEL, NSW).

***Notes*:** Together with *Zieria vagans* and *Z. verrucosa*, this species forms a trio of closely related and similar appearing taxa. While all three species are immediately recognisable on gross morphology from dried specimens, it is necessary to be observant as to the distribution of hairs and glands on the foliage and flowers, as well as the shape and dimensions of the leaflets. *Z. distans* is a much smaller plant than the other two species and has noticeably smaller foliage. It differs from *Z. verrucosa* in the much smaller leaves that are held patently or erect (versus drooping), the leaflets that are narrow-elliptic (versus linear) and with a length/width ratio of 3.6–10.1 (versus 10–25.3), the linear inflorescence bracts (versus narrow-oblong) and the sepals being densely beset with glands (versus scattered). *Z. distans* differs from *Z. vagans* in the broader leaflets with a length/width ratio of 3.6–10.1 (versus 7.5–10.8) and that have the midrib ± glabrous to sparsely indumented below (versus woolly stellate-tomentose), the leaf-bearing branchlets being glabrescent to sparsely and minutely stellate tomentose between glands (versus woolly stellate-tomentose all over), the linear inflorescence bracts (versus narrow-oblong) and the base of the sepals being stellate tomentose abaxially, including on the glands (versus glabrescent between glands).

***Distribution and habitat*:** *Zieria distans* is endemic to Qld and has been collected from Walla Range near Coalstoun Lakes, Coongara Rock, Kroombit Tops, Westwood Range and the Mt Roberts area within the Southeast Queensland bioregion (**Map 5**). In all habitats it is an inhabitant of clefts and crevices in rocky situations. At Kroombit Tops the species has been collected on rhyolitic rock pavements with *Triplarina volcanica*, and at Mt Roberts in tall open shrubland of *Lophostemon confertus* with much bare rock (granodorite). At Mt Walla the plants occur in an ecotone between woodland of *Corymbia citriodora* subsp. *variegata* and fragmented semi-evergreen vinethicket on rhyolitic ignimbrite. At Coongara Rock, the plants occur on rock faces or rubble at the base of clifflines, once again on rhyolitic ignimbrite, in woodland of *Araucaria cunninghamii* and

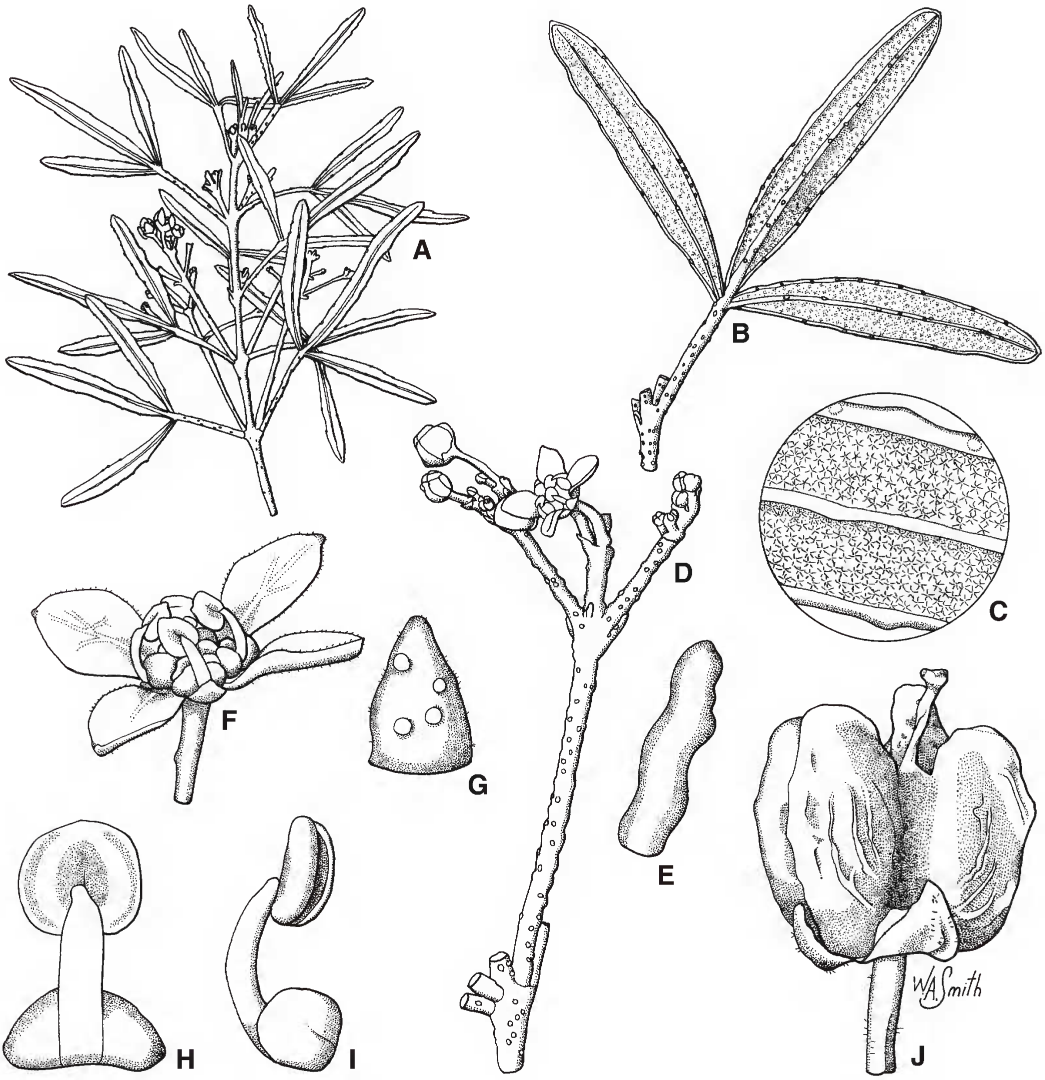


Fig. 6. *Zieria distans*. A. branch with several flowering inflorescences × 1. B. stem node with abaxial view of leaf × 2. C. detail of indumentum on abaxial surface of leaflet × 20. D. inflorescence with buds & flower × 3. E. inflorescence bract × 20. F. flower × 8. G. tip of sepal × 20. H–I. views of stamens × 20. J. mature fruit with multiple cocci × 16. A from *Forster PIF28853* (BRI); B & J from *Forster PIF29192* (BRI); C–I from *Forster PIF28835* (BRI). Del. W. Smith.

Acacia blakei or *Corymbia citriodora* and *Eucalyptus acmenoides*.

***Phenology*:** Flowers have been collected from May to September, and fruit in December.

***Conservation status*:** The populations at Kroombit Tops N.P. and Westwood Range (in Eurimbula N.P.) are probably reasonably conserved and those at Coongara Rock and Mt Roberts are within State Forests and Timber Reserves. The population at Walla Range is on private land and is not conserved. At this site, *Z. distans* occurs in close proximity to populations of the endangered *Pomaderris clivicola* E.M.Ross and *Phebalium distans* P.I.Forst. It is possible that thousands of plants occur at Kroombit Tops, and several hundred at Walla Range and Coongara Rock. However, in all instances the populations are relatively restricted and some (e.g. Walla Range) are subjected to regular catastrophic disturbance by fires fuelled by exotic grass species. This species can be assessed as **Near Threatened** on the basis of criterion D (IUCN 2001). Surveys are required to ascertain the number of populations, number of individuals and the area of occupancy.

***Etymology*:** The epithet is derived from the Latin *distans* (being apart, well separated), and alludes to the disjunct populations of this species that occur on the tops of mountains or ranges.

13. Zieria eungellaensis Duretto & P.I.Forst. **species nova** a *Z. montana* J.A.Armstr. foliolis minoribus, 3–16 mm longis (non 20–45 mm) et floribus paucioribus (1–3 adversum magis quam 10) in quaque inflorescentia differt. **Typus:** Queensland. South Kennedy District: Mt William, Eungella Range [Eungella National Park], 21°01′S, 148°36′E, 8 August 1978, *P.Hind 2263* (holo: BRI; iso: MEL 2189242, NSW 458969).

***Illustrations*:** Pearson & Pearson (1992: 214) [as *Z.* sp. nov. (Mt William)]; Armstrong (2002: 399, Fig. 86c) [as *Z. montana*].

Shrub to 2 m tall forming an openly compact bush. Stems erect, wiry; branches with prominent decurrent leaf bases, conspicuously scarred from fallen buds and leaves, not or faintly glandular verrucose, glabrous (Mt William & Mt Dalrymple) or with a moderately dense indumentum of simple, bifid and mainly stellate hairs (Mt David), older branches becoming glabrous, sometimes older branches becoming lenticellate and corky. Leaves palmately trifoliolate, glabrous or glabrescent along midvein (Mt William & Mt Dalrymple) or with a sparse indumentum of simple and bifid hairs that is denser on the midribs (Mt David); petioles 2–8 mm long, very slightly glandular verrucose; terminal leaflets elliptic to obovate, 5–14 (–16 Mt David) × 3–8 mm, laminae not glandular verrucose, tips obtuse (Mt William & Mt Dalrymple) or acute (Mt David), margins flat and crenulate, flat (can become revolute on drying), midveins raised abaxially, secondary veins obscure; lateral leaflets similar to terminal leaflets though usually slightly smaller, 3–13 × 2–8 mm. Inflorescence axillary, shorter than the subtending leaf, 1–3-flowered, not glandular verrucose, glabrous or glabrescent (Mt William & Mt Dalrymple) or with a sparse to moderately dense indumentum of mainly simple and bifid hairs (Mt David); peduncle 1–3 mm long,; bracts scale like, persistent, not or slightly glandular verrucose; pedicels 1–2.5 mm long. Sepals deltate, 0.7–0.8 × 0.6–1 mm, valvate in bud, tips acute, glabrous (Mt William & Mt Dalrymple) or adaxial surfaces with scattered appressed hairs and abaxial surfaces with a sparse indumentum of simple and bifid hairs concentrated near base (Mt David), abaxial surfaces slightly glandular verrucose. Petals elliptic, 2.5 (Mt David)–3.5 (Mt William & Mt Dalrymple) × 1.2–1.5 mm, white to pink, valvate in bud, dotted with pellucid glands, adaxial surfaces with dense stellate indumentum, abaxial surfaces with a sparse stellate indumentum though pubescent along margins (Mt William & Mt Dalrymple) to moderately dense stellate indumentum (Mt David). Staminal filaments *c.* 1 mm long, glabrous or with scattered simple hairs, not or slightly glandular distally; anthers *c.* 0.7–1 mm long, apiculum absent. Gynoecium glabrous. Cocci 2.5–3.5 × 2–2.5 mm, smooth, glabrous, base of style persistent forming a minute apical apiculum. Mature seeds not observed. **Fig. 7.**

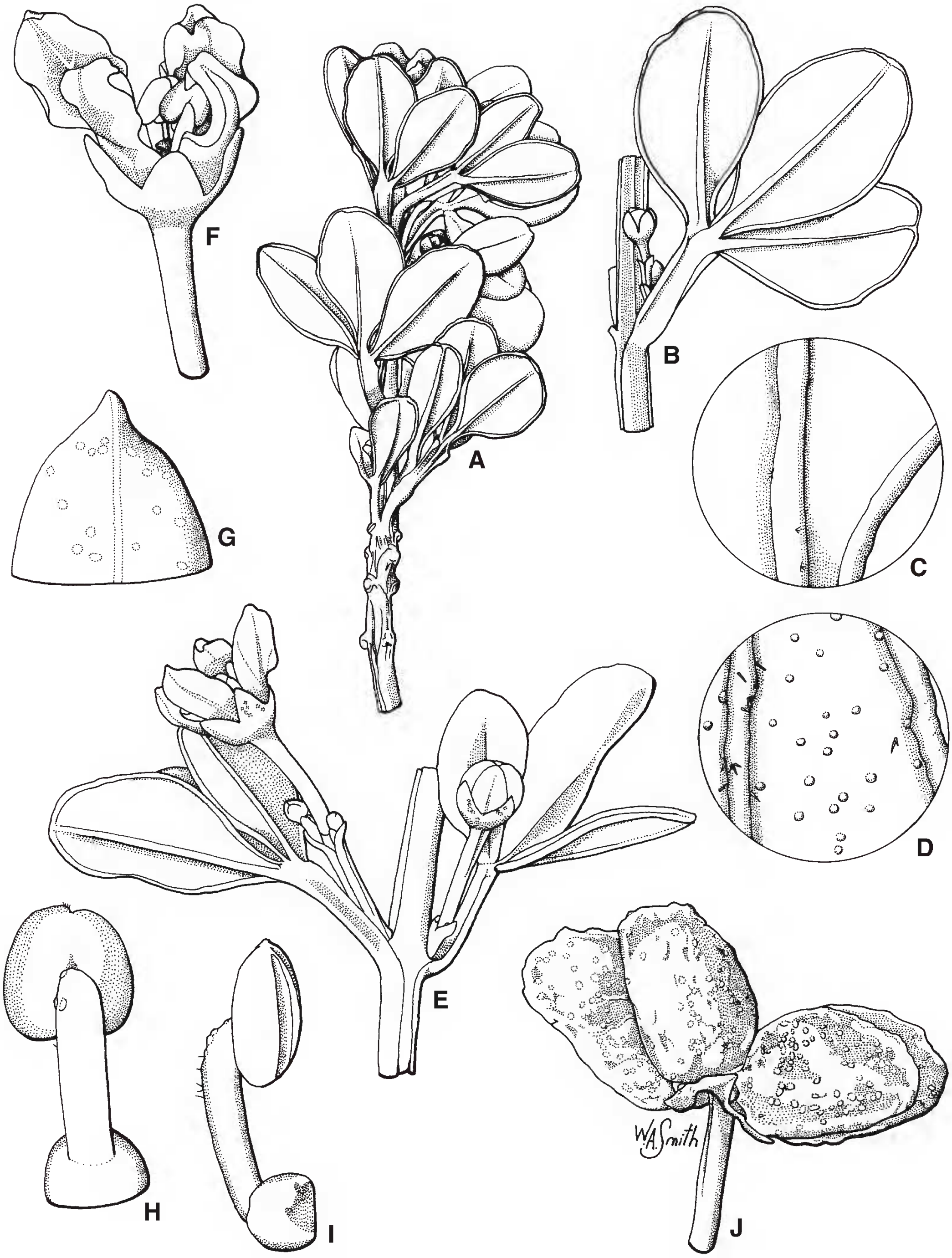


Fig. 7. ***Zieria eungellaensis.*** A. branch with several flowering inflorescences (obscured by leaves) × 2. B. stem node with abaxial view of leaf × 4. C–D. detail of indumentum variation on abaxial surface of leaflets from different localities × 20. E. stem node with two inflorescences with bud and flower × 4. F. flower × 8. G. tip of sepal × 20. H–I. views of stamens × 20. J. mature fruit with multiple cocci × 8. A–C from *Hind 2263* (BRI); D & J from *Bean 4435* (BRI); E–I from *Bean 4444* (BRI). Del. W. Smith.

Additional specimens examined: **Queensland:** South Kennedy District: Mt William, Eungella N.P., Aug 1984, *McDonald 2* (BRI); *loc. cit.*, Aug 1989, *Pearson 45* (BRI); *loc. cit.*, May 1992, *Bean 4444* (BRI); N.P.R. 573, Mt William, 21°00′S, 148°35′E, *s.dat.*, *Hanson EUN116P* (NSW); *loc. cit.*, 20°01′S, 148°36′E, Apr 1981, *Hyland 11010* (NSW); Clarke Range, Eungella N.P., Mt Dalrymple, 21°02′S, 148°38′E, Apr 1991, *Telford 11165 & Rudd* (CANB); WSW of Mt David, Eungella N.P., 21°02′S, 148°37′E, May 1992, *Bean 4435* (BRI, HO, MEL).

Notes: Specimens of *Zieria eungellaensis* were included under a broadly circumscribed *Z. montana* by Armstrong (2002). The latter species is now considered to be restricted to Mt Barney in SE Qld and *Z. eungellaensis* differs in the smaller leaflets (3–16 mm long; *cf.* 20–45 mm long) and by having fewer flowers per inflorescence (1–3; *cf.* >10).

Zieria eungellaensis appears to have two variants: a glabrous or glabrescent variant from Mt William and Mt Dalrymple and a hirsute variant from nearby Mt David (see description above). The material from Mt David also has leaflets with acute tips as compared to the obtuse tips found on the material from the other two areas. The hirsute stems are similar to those found in *Z. robertsiorum* from the Wet Tropics bioregion. Material from Mt David differs from *Z. robertsiorum* in having an indumentum of mainly simple hairs on the leaves (versus stellate) and the tips of the leaflets being acute (versus obtuse). Field and laboratory research is required to determine if the variation seen in *Z. eungellaensis* warrents taxonomic recognition. Any field research should include surveys of other localities in the Eungella area similar to where these taxa have been collected.

Distribution and habitat: *Zieria eungellaensis* is endemic to Qld and appears to be confined to the Clarke Range where it is known from a few collections from the Mt William summit area (*c.* 1250 m), and single collections from both Mt Dalrymple (*c.* 1300 m), and Mt David (*c.* 1250 m), Eungella N.P.; all within the Central Queensland Coast bioregion (**Map 5**). The species is found in windswept heath on decomposed granitic soil where it grows in clefts and crevices and small patches of dense vegetation. Associated taxa include species of *Hakea*, *Banksia*, *Acacia*, *Hibbertia*, *Acrotriche*, *Leucopogon*, *Gonocarpus* and *Rhodomyrtus*.

Phenology: Flowers have been collected in May and August, and fruit in April and August.

Conservation status: No population data was given with the specimens made on Mt William and Mt David though collector's notes with *Telford 11165* indicate that it was rare on Mt Dalrymple. All known collections were made within Eungella N.P. A conservation status of **Vulnerable** based on the D2 criterion (IUCN 2001) can be allocated to this taxon purely on the limited distribution and apparent small population size. Survey work is required to determine the number of populations, number of individuals, area of occupancy and perceived threats.

Etymology: The specific epithet refers to the National Park this species appears to be endemic to.

14. Zieria exsul Duretto & P.I.Forst., **species nova** *Z. compacta* C.T.White caulis indumento divaricato (in illa antrorso), foliorum indumento simplici sparso (adversum glabrum vel rarius pilosum), inflorescentia glabra (adversum indumentum sparsum usque densum), petalis brevioribus (2–2.5 non 3.5–5 mm) et coccis glabris (in illa indumento stellato in acie interiore praeditis) differens. **Typus:** Queensland. Moreton District: Sugarbag road, Caloundra, 16 March 1997, *A.R.Bean 11773* (holo: BRI; iso: MEL 306832, NSW).

Zieria sp. (Mooloolaba G.Leiper AQ636552); Forster (2002: 181; 2007: 183).

Illustration: Logan River Branch SGAP (QLD Region) Inc. (2005: 176) [as *Z.* sp. Mooloolaba].

Shrub to 60 cm tall forming an open, straggly bush. Stems erect to decumbent, spindly; branches without decurrent leaf bases, not obviously glandular, with a sparse to moderately dense indumentum of simple, bifid to stellate hairs. Leaves palmately trifoliolate, not obviously glandular though weakly pellucid gland dotted; petioles 2–3 mm long, sparsely pilose; terminal leaflets obovate, 10–16 × 2.5–5 mm, tips acute to apiculate, margins recurved to revolute, midrib and some secondary veins raised abaxially, adaxial surfaces sparsely pilose, abaxial surfaces densely stellate tomentose; lateral leaflets similar to terminal leaflets but smaller, 5–12 × 2–4 mm. Inflorescence axillary, longer than the subtending leaf, 1–12-flowered, not or weakly glandular verrucose, glabrous; peduncle 10–19 mm long; bracts linear-lanceolate, persistent, 2–2.5 mm long; secondary peduncles 3–10 mm long; pedicels 1.3–2.5 mm long, not obviously glandular, glabrous and slightly glaucous. Sepals ovate-triangular, 1–1.2 × 0.8–1 mm, valvate in bud, not glandular tuberculate, tips acute and inflexed, adaxial surfaces minutely pilose, becoming glabrous towards centre, abaxial surfaces glabrous and slightly glaucous. Petals elliptic, 2–2.5 × *c.* 1.5 mm, white though drying pink, valvate in bud, not obviously glandular, adaxial surfaces minutely pilose, abaxial surfaces densely stellate-tomentose. Staminal filaments *c.* 0.7 mm long, glabrous, eglandular; anthers *c.* 0.5 mm long, apiculum absent. Gynoecium glabrous. Cocci 3–5 × 2–2.5 mm, slightly glandular verrucose, glabrous, base of style persistent forming a minute apical apiculum. Seeds oblong-ovoid, 2.8–3 × 1.4–1.5 mm, longitudinally striate, dark-brown. **Fig. 8.**

***Additional specimens examined*: Queensland.** MORETON DISTRICT: along old Mooloolaba Bypass road, *c.* 300 m S of Buderim road intersection, Jan 1993, *Leiper s.n.* (BRI [AQ561989]); Intersection of Mooloolaba–Buderim road and new toll road to Kawana, Jan 1995, *Leiper s.n.* (BRI [AQ636552]); *loc. cit.*, Sep 2002, *Leiper s.n.* (BRI); Buderim, near Sunshine motorway, Aug 1996, *Patterson s.n.* (BRI [AQ652665]); Buderim, adjacent to Sunshine motorway and corner of Mooloolabah road, 26°41′S, 153°06′E, Oct 2002, *Forster PIF28967* (BRI, HO, MEL, NSW).

***Notes*:** *Zieria exsul* appears to be closely allied to *Z. compacta* but differs in the stem indumentum being divaricate (versus antrorse), the adaxial surface of the leaves with a sparse, simple indumentum (versus glabrous usually, rarely sparsely pilose), the glabrous inflorescence (versus with sparse to dense indumentum), the shorter petals (2–2.5 mm versus 3.5–5 mm long) and the cocci glabrous (versus with sparse stellate hairs on the inner edge). *Z. exsul* is always a weak, spindly subshrub with inflorescences that are markedly longer than the subtending leaf, whereas in nearly all cases *Z. compacta* is a somewhat woody erect bush and has the inflorescence either shorter or as long as the subtending leaf. There are however the occasional exceptions to these latter characters (at least in *Z. compacta*) so they are not reliably diagnostic.

***Distribution and habitat*:** *Zieria exsul* is endemic to Qld and has been collected from two localities (both roadside remnants), near Buderim and Caloundra within the Southeast Queensland bioregion (**Map 5**). This species has been found in wallum heathland as well as woodland of *Corymbia trachyphloia*, *Eucalyptus siderophloia*, *E. racemosa*, and *Allocasuarina littoralis*. At the Buderim locality it co-occurs with *Z. minutiflora* subsp. *minutiflora*.

***Phenology*:** Flowers have been collected in March, September and October, and fruit in March.

***Conservation status*:** This species was known from only two populations and the total number of plants is less than 100. The Buderim population has been bisected and ± destroyed by recent motorway extensions and powerline maintenance work. At the Caloundra locality only 10 plants were noted in 1997. There has been widespread destruction of wallum heathland in the area between Buderim and Caloundra, both for agriculture, forestry plantations, housing and tourist developments. The species can be assessed as **Critically Endangered** under the IUCN categories of A1(a),(c), 3; B2b(i–v) (IUCN 2001).

***Etymology*:** The specific epithet is derived from the Latin word *exsul* (banished, exile) and alludes to plants of this species having been destroyed over much of its probable former range.

15. Zieria fraseri Hook. in T.L.Mitchell, *J. Exp. Int. Trop. Australia* 339 (1848); *Zieria laevigata* Sm. var. *fraseri* (Hook.) Domin, *Repert. Spec. Nov. Regni. Veg.* 12: 133 (1913). **Type:** Queensland. MORETON DISTRICT: Mt Lindesay [actually Mt Barney], *C.Fraser s.n.*

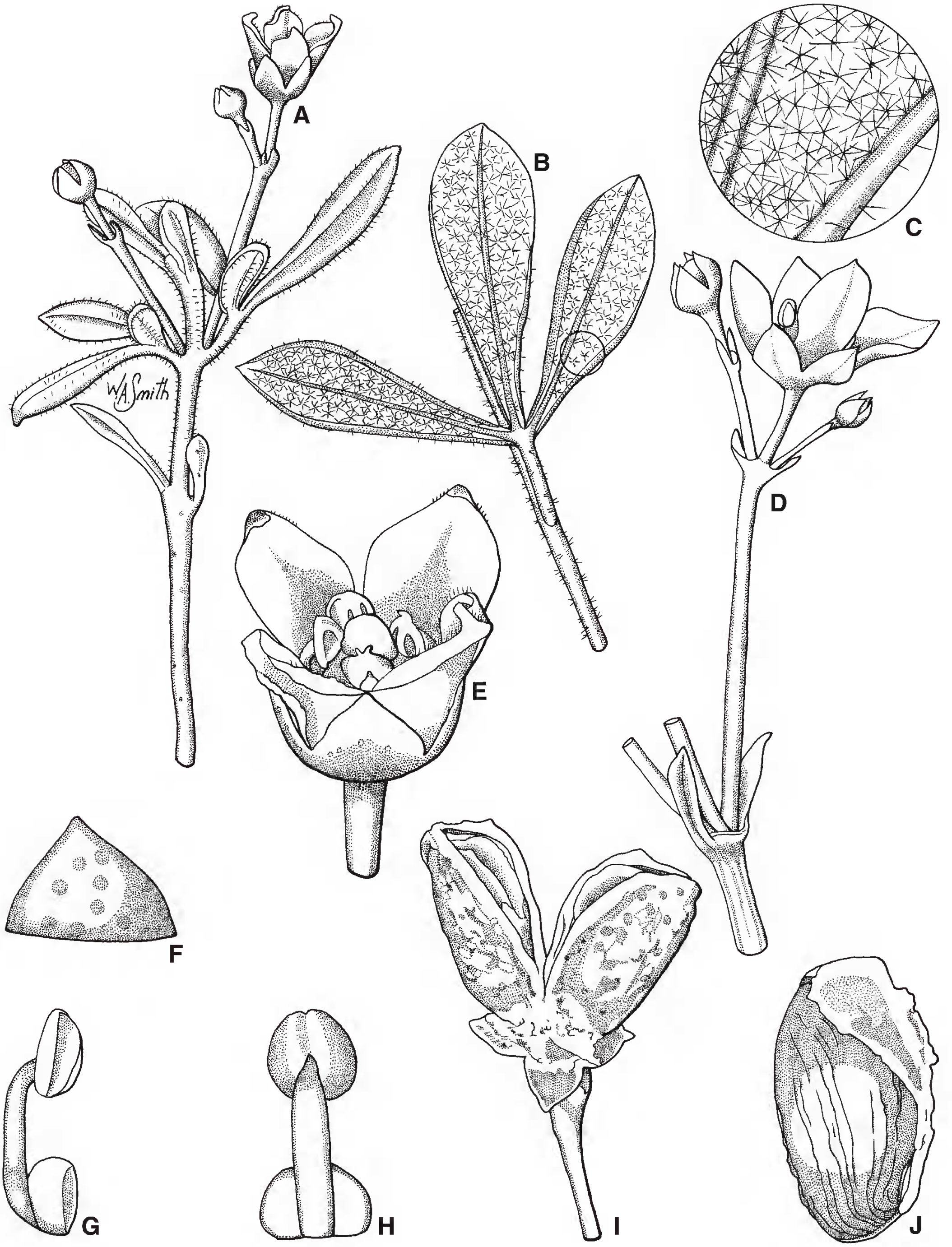


Fig. 8. ***Zieria exsul*****.** A. branch with several flowering inflorescences × 4. B. stem node with abaxial view of leaf × 4. C. detail of indumentum on abaxial surface of leaflet × 20. D. inflorescence with buds and flower × 6. E. flower × 12. F. tip of abaxial side of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. J. lateral view of seed × 12. A, E–H from *Forster PIF28967* (BRI); B–D from *Bean 11773* (BRI); I–J from *Leiper s.n.* (BRI). Del. W. Smith.

(holo [*fide* Armstrong 2002: 352]: K 347899 [images BRI, HO 534656]).

Shrub to 2 m tall forming a densely compact bush. Stems erect, wiry; branches without decurrent leaf bases, not obviously glandular, glabrous (subsp. *robusta*) or with a sparse (subsp. *robusta*) to dense indumentum of stellate, simple and bifid hairs. Leaves palmately trifoliolate, not obviously glandular; petioles 2–10 mm long, with a sparse to dense indumentum of simple and stellate hairs; terminal leaflets narrow elliptic to narrow obovate, 8–51 × 1–8 mm, tips acute, margins recurved to revolute, midribs strongly raised abaxially, secondary veins not or weakly raised abaxially, adaxial surfaces mostly glabrous with a few scattered hairs along midrib and margins, abaxial surfaces densely stellate-tomentose though midribs almost glabrescent or with a sparse to moderately dense indumentum (epidermous clearly visible); lateral leaflets similar to terminal leaflets though usually smaller, 7–50 × 1–8 mm. Inflorescence axillary, shorter or longer than the subtending leaf, 3–20^{+}-flowered, not obviously glandular, glabrous or with a sparse to moderately dense indumentum of simple, bifid and stellate hairs, sometimes glaucous; peduncle 4–37 mm long; bracts lanceolate, often leaf-like, persistent, 1–20 mm long; secondary peduncles 1–15 mm long; pedicels 2–6 mm long, glabrous, stellate glabrescent or with a sparse to moderately dense stellate indumentum. Sepals ovate-triangular, sometimes broadly so, 1.5–2.1 × 1.5–2.1 mm, slightly imbricate in bud, not obviously glandular, tips acute to acuminate, straight, adaxial surfaces with scattered simple and stellate hairs mainly towards tip, abaxial surfaces glabrous or with a few stellate hairs at base, sometimes glaucous. Petals elliptic, 2.5–6 × 1.5–4 mm, white to pink, imbricate in bud, not obviously glandular, adaxial surfaces with a sparse to dense indumentum of simple and stellate hairs, abaxial surfaces densely stellate-tomentose. Staminal filaments 1–1.5 mm long, glabrous or with few hairs, weakly glandular verrucose at tip; anthers 0.7–1 mm long, apiculum absent or present. Gynoecium glabrous. Cocci 3.5–4.5 × 2.5–3.2 mm, not glandular verrucose, glabrous, base of style persistent forming a minute apical apiculum. Seeds (seen for subsp. *robusta* only) oblong-ovoid to ovoid, 2.1–3.1 × 1.2–1.75 mm, black, shiny, striate.

***Typification*:** Charles Fraser probably collected the type of *Zieria fraseri* on the present day Mt Barney as both he and Alan Cunningham misnamed this peak as Mt Lindesay (Telford 1990; Forster 1994b). This species has not been collected on Mt Lindesay to date.

***Notes*:** As circumscribed by Armstrong (2002), *Zieria fraseri* comprised two subspecies: subsp. *fraseri* and subsp. *compacta.* Armstrong considered that subsp. *fraseri* was markedly disjunct in Qld with populations at the Blackdown Tableland (named by White (1942) as *Z. compacta* var. *glabrata* and *Z. compacta* var. *robusta*) and populations in the Moreton District on the ‘Scenic Rim’. For the other subspecies that he recognised (*Z. fraseri* subsp. *compacta*) we have resurrected *Z. compacta* at specific rank (see earlier).

It is considered that *Zieria compacta* var. *glabrata* and *Z. compacta* var. *robusta* are conspecific with *Z. fraseri,* but that a single taxon based on these two varieties and distinguishable on leaf characters and floral size can be recognised as a disjunct subspecies of *Z. fraseri*.

Key to the subspecies of *Z. fraseri*

1. Inflorescence shorter than the subtending leaf (rarely longer and then pedicel with a dense indumentum); branches hirsute; pedicel glabrescent or sparsely to densely indumented; anther apiculum absent . . . . subsp. **fraseri**

Inflorescence longer than the subtending leaf (rarely shorter and then pedicel and/or branches glabrous); branches glabrous or hirsute; pedicel glabrous or sparsely indumented; anther apiculum absent or present . . . subsp. **robusta**

15a. Zieria fraseri Hook. subsp. **fraseri**

***Illustrations*:** Armstrong (2002: 308); Logan River Branch SGAP (QLD Region) Inc. (2002: 328).

Shrub to 1 m tall; young branches with a dense indumentum of mainly stellate hairs but simple and bifid hairs also present. Petioles 2–6 (–10 Mt Ernest) mm long, with a dense indumentum of simple and stellate hairs; terminal leaflets 8–38 × 1–6 mm wide; lateral leaflets 7–34 × 1.5–6 mm. Inflorescence axillary, shorter (very rarely longer and then barely, Mt Ernest) than the subtending leaf, 3–12-flowered, with a moderately dense indumentum of simple, bifid and stellate hairs; peduncle 4–15 (–25 Mt Ernest) mm long; bracts 1–3.5 (–12 Mt Ernest) mm long; secondary peduncles 1–8 mm long; pedicels 2–4 mm long, stellate glabrescent or with a sparse to moderately dense stellate indumentum. Sepals ovate-triangular, 1.5–2 × 1.5–1.75 mm, abaxial surface glabrous or with stellate hairs at base. Petals 2.5–4.5 × 1.5–2 mm. Staminal filaments glabrous or with a few hairs; anther apiculum absent. Cocci 3.5–5 × 2.5–3 mm. Mature seeds not seen.

***Additional selected specimens examined*:** **Queensland.** Moreton District: Northern slopes of Mt Maroon [Mt Barney N.P.], 28°12′S, 152°43′E, May 1990, *Forster PIF6834 et al.* (BRI, MEL); Mt Maroon, 28°12′S, 152°43′E, Sep 1994, *Forster PIF15710* (BRI); Mt Maroon, SE side, 28°12′S, 152°43′E, Sep 1996, *Leiper s.n.* (BRI [AQ650109]); Mt May [Moogerah Peaks N.P.], 28°13′S, 152°32′E, Sep 1992, *Forster PIF11767 et al.* (BRI); Mt Barney [N.P.], south-east ridge of East Peak, 28°17′S, 152°41′E, Sep 1994, *Forster PIF15719* (BRI); Campbells Folly, 4 km SW of Tylerville, 28°18′S, 152°44′E, Sep 1992, *Forster PIF11515 & Leiper* (BRI); 1.5 km WSW of Mt Ernest, 28°19′S, 152°41′E, Aug 1999, *Halford Q3824* (BRI); Mt Ernest [Mt Barney N.P.], 28°19′S, 152°42′E, Sep 1990, *Forster PIF7389 et al.* (BRI, CANB); Mt Ernest, near Aratula, 28°19′S, 152°43′E, Sep 1989, *Leiper s.n.* (BRI [AQ458075, AQ458078]); Mt Gillies, 20 km SW of Rathdowney on Mt Lindsay Highway, Oct 1974, *Sharpe 1080* (BRI); Mt Gillies, 16 km SW of Rathdowney, 28°20′S, 152°45′E, Jul 1996, *Telford 12120 & S. Donaldson* (CANB, NE).

***Notes*:** All of the specimens listed in the '*Selected specimens examined*' under *Zieria fraseri* subsp. *fraseri* by Armstrong (2002) are referable to *Z. fraseri* subsp. *robusta*.

***Distribution and habitat*:** *Zieria fraseri* subsp. *fraseri* is found on some of the peaks of the 'Scenic Rim' (Forster 1994b) in south-eastern Qld (eg. Campbells Folly, Mt Maroon, Mt May, Mt Ernest, Mt Barney, Mt Gillies) within the Southeast Queensland bioregion and from the North Obelisk in north-eastern NSW (**Map 3**). Plants grow in clefts and crevices in rocky areas of pavement or clifflines of granophye (Mt Barney) or rhyolite (remaining peaks) (Willmott 2004), usually in heathland or shrubland though on Mt May it is found in open woodland of *Eucalyptus dura*.

***Phenology*:** Flowers have been collected in May and from July to October; fruits have been collected in September and October.

***Conservation status*:** This taxon is common and widespread on the 'Scenic Rim' and is present in National Parks such as Mt Barney (peaks of Mt Maroon, Mt Ernest, Mt Barney) and Moogerah Peaks (Mt May). A conservation status of **Least Concern** (IUCN 2001) is recommended.

15b. Zieria fraseri subsp. **robusta** (C.T.White) Duretto & P.I.Forst., **comb. et stat. nov.;** *Zieria compacta* var. *robusta* C.T.White, *Proc. Roy. Soc. Queensland* 53: 210 (1942). **Type:** Queensland. Leichhardt District: Blackdown Tableland, September 1937, *H.G.Simmons 73* (holo: BRI).

Zieria compacta var. *glabrata* C.T.White, *Proc. Roy. Soc. Queensland* 53: 209 (1942). **Type:** Queensland. Leichhardt District: Blackdown Tableland, September 1937, *H.G.Simmons 57* (holo: BRI).

***Illustrations*:** Williams (1984: 297) [as *Z. compacta* var. *glabrata*]; Pearson & Pearson (1989: 404) [as *Z. compacta* var. *glabrata*].

Shrub to 2 m tall; young branches with a sparse to dense indumentum of stellate simple and bifid hairs, or glabrous (Blackdown Tableland). Petioles 2–10 mm long, with a sparse to dense indumentum of simple and stellate hairs; terminal leaflets 15–51 × 1.5–8 mm; lateral leaflets 13–50 × 1–8 mm. Inflorescence longer than the subtending leaf, 3–20+-flowered, glabrous or with a sparse to moderately dense indumentum of simple, bifid and stellate hairs, sometimes glaucous; peduncle (4– Yandburra Station) 25–37 mm long; bracts 1–8 (–20 Blackdown Tableland) mm long; secondary peduncles 3–15 mm long; pedicels 2–6 mm long, glabrous, stellate or simple glabrescent or with a sparse to indumentum of stellate and simple hairs. Sepals broadly ovate-triangular, 1.7–2.1 mm long and wide, abaxial surfaces glabrous or glabrescent with a few stellate hairs at base, sometimes glaucous. Petals 4–6 × 2.5–4 mm. Staminal filaments 1–1.5 mm long, glabrous (Central Qld) or with a few hairs (Blackdown Tableland); anther apiculum absent, minute to large. Cocci 4.3–4.5 × 3–3.2 mm. Seeds oblong-ovoid to ovoid, 2.1–3.1 × 1.2–1.75 mm, black, shiny, striate.

***Additional selected specimens examined*: Queensland.** LEICHHARDT DISTRICT: Near Peregrine Point, Blackdown Tableland [N.P.], 23°44′S, 149°05′E, Sep 1984, *Anderson 3814* (BRI); Blackdown Tableland, 23°46′S, 149°02′E, Jun 1977, *Telford 5727 & Ellyard* (BRI, CANB); Blackdown Tableland, 23°47′S, 149°07′E, Sep 1974, *Williams 74018* (BRI); Blackdown Tableland [N.P.], Stony Creek Vehicle parking area, 23°48′S, 149°08′E, Jul 1985, *Williams 85035 & 85036* (BRI); Blackdown Tableland, Stony Creek track, Aug 1985, *Williams 80198* (BRI); Blackdown Tableland, Aug 1973, *Trapnell 28 & Williams* (BRI); Blackdown Tableland, Sep 1971, *Henderson H962, H1201 & H1202 et al.* (BRI); Yandaburra Station, 24°42′S, 147°30′E, Sep 1984, *O'Keefe 674* (BRI); Salvator Rosa N.P., Sentinel Mt, 24°48′S, 147°08′E, Oct 1981, *Ballingall MEB442 & Cockburn* (BRI); Salvator Rosa [Carnarvon] N.P., Aug 1994, *O'Keefe 1075* (BRI); Mt Playfair – Mt Faraday area, Sep 1982, *O'Keefe s.n.* (BRI [AQ348712]); Ka Ka Mundi [Carnarvon] N.P., Bunbuncundoo Spring area, 24°52′S, 147°26′E, Sep 1993, *Purdie 4336* (CANB); Near Burnley road, S.F. 44, WSW of Theodore, 25°02′S, 149°46′E, Jan 2003, *Bean 19861* (BRI).

***Notes*:** All of the specimens listed in the '*Selected specimens examined*' under *Zieria fraseri* subsp. *fraseri* by Armstrong (2002) are referable to *Z. fraseri* subsp. *robusta*.

Zieria fraseri subsp. *robusta*, especially populations on the Blackdown Tableland, can have noticeably longer leaflets and much larger flowers than *Z. fraseri* subsp. *fraseri* though the variation seen in the subspecies overlaps. As noted by Armstrong (2002), individuals with both glabrous and pubescent stems may occur in the same population on the Blackdown Tableland.

The collections from Yandaburra Station (*O'Keefe 674*) and from near Theodore (*Bean 19861*) and Carnarvon Gorge (*Parris 9110*) have inflorescences that are shorter than the subtending leaves. The specimen from near Theodore (*Bean 19861*) is the only collection of this taxon from outside the Blackdown Tableland and the Salvator Rosa/Carnarvon Gorge area. It was collected in midsummer and this may be why the inflorescence appears to be shorter than the leaves, that is, well outside the normal flowering time for the taxon (see below). All three collections do have sepals and pedicels that are glabrous and glaucous. These populations require further investigation.

***Distribution and habitat*:** *Zieria fraseri* subsp. *robusta* is endemic to Qld within the Brigalow Belt bioregion and is found mainly in two areas, the Blackdown Tableland and Salvator Rosa though isolated collections have been made at Carnarvon Gorge (Wards Canyon) and from near Theodore (**Map 3**). Armstrong (2002) mapped these areas, but did not mention the populations at Salvator Rosa in his discussion on the distribution of *Z. fraseri*.

At Blackdown Tableland and Salvator Rosa the subspecies is found in open *Eucalyptus* or *Eucalyptus*/*Allocasuarina* forest or shrubland/heath on sand or sandstone; at Carnarvon Gorge (Wards Canyon) at the foot of vertical cliffs, amongst boulders in a woodland of *E. propinqua* and *Livistona fulva*; near Theodore it was collected on the edge of a sandstone escarpment in a low woodland of *Corymbia trachyphloia, Eucalyptus tenuipes, Lysicarpus angustifolius* and *Petalostigma pachyphyllum*.

***Phenology*:** Flowers have been collected in August and September, and fruits in October and rarely in January.

***Conservation status*:** This subspecies is widespread and locally common and is primarily found in National Parks. A conservation status of **Least Concern** (IUCN 2001) is recommended.

***Etymology*:** We have used White's varietal epithet *robusta* as it suitably describes the more robust habit of this subspecies.

16. Zieria furfuracea R.Br. ex Benth., *Fl. Austral.* 1: 306 (1863). **Type:** New South Wales. North Coast: Hastings River, *Beckler s.n.* (lecto [designated by Armstrong (2002: 358)]: K [Herbarium Hookerianum]; isolecto: MEL 62061, 62062, 62063).

Notes: As circumscribed by Armstrong (2002), *Zieria furfuracea* comprises three subspecies distributed from north-eastern NSW to south-eastern Qld, with the nominate subspecies not occurring in Qld.

In his key to the subspecies of *Zieria furfuracea*, Armstrong (2002) outlines a range of character states (especially bud aestivation) that may justify recognition of these taxa at specific rank. The three subspecies that he recognises are all quite disjunct in their occurrence, with few obvious regions of intergradation. Despite this, these different subspecies are all superficially similar and would appear to form a monophyletic group.

Key to the subspecies of *Z. furfuracea* found in Queensland

1. Leaflet lamina margin entire or somewhat sinuate with poorly developed marginal glands; petals valvate in bud . . . . .subsp. **euthadenia**
   Leaflet lamina margin crenate with well developed marginal glands; petals imbricate in bud . . . . .subsp. **gymnocarpa**

16a. Zieria furfuracea subsp. **euthadenia** J.A.Armstr., *Austral. Syst. Bot.* 15: 362 (2002). **Type:** Queensland. Moreton District: Kin Kin, January 1917, *C.T.White s.n.* (holo: BRI [AQ318532]).

Zieria furfuracea subsp. (Kin Kin V.K.Moriarty 134); Forster (2002: 181).

Illustrations: Hauser & Blok (1998: 368) [as *Z. furfuracea*]; Armstrong (2002: 363).

Additional specimens examined: **Queensland.** Wide Bay District: Mt Woocoo, S.F. 57, St Mary, 25°40′S, 152°23′E, Jun 1993, *Forster PIF13375 & Machin* (BRI, CANB, MEL); *loc. cit.*, Apr 1996, *Forster PIF19115 & Leiper* (AD, BRI, MEL); *loc. cit.*, Aug 1996, *Forster PIF19503 & Leiper* (AD, BRI, CANB, MEL, NSW, NY); *loc. cit.*, Mar 2000, *Forster PIF25347 & Booth* (AD, BRI, HO, MEL, NE, NSW); Parsons road, west of Mt Coondoo, via Kin Kin, 26°11'S, 152°55'E, Sep 1993, *Bean 6488* (BRI, MEL). Moreton District: Como S.F., S.F. 1004, Toolara, just off Kin Kin – Pomona road, 26°12′S, 152°54′E, Feb 1994, *Grimshaw G487 & Spearritt* (BRI); Beenham Range, about 6 km N of Kin Kin, 26°13′S, 152°51′E, May 1988, *Sharpe 4809* (BRI); W slopes of Mt Tinbeerwah, 6 km W of Tewantin, 26°23′S, 152°58′E, Dec 1990, *Bean 2822* (BRI); Yandina Creek, about 12 km NE of Yandina, 26°30′S, 153°00′E, Apr 1991, *Sharpe 5012 & Thomas* (BRI, MEL); Belli L.A., Mapleton S.F., SW of Eumundi, 26°31′S, 152°51′E, Apr 1998, *Bean 13192* (BRI, MEL); S.F. 689, N of the Valdora to North Arm road, Alandale road to the East, 26°31′S, 152°59′E, Aug 1999, *Thomas 408M* (BRI); Scrubby Pocket road, Mapleton S.F., south of Belli, 26°32′S, 152°51′E, Mar 1993, *Bean 5901* (BRI; NSW n.v.); Rocky Creek, S.F. 249, SE of Yandina, 26°35′S, 152°59′E, Apr 1990, *Bean 1501* (BRI); Dularcha N.P., N of Landsborough, 26°47′S, 152°58′E, Jan 1990, *Bean 1319* (BRI).

Notes: This taxon was recognised by Armstrong (2002) as a subspecies of *Zieria furfuracea*, although there appears to be some confusion in that account as to where he considered *Z. furfuracea* subsp. *furfuracea* to occur. In the specimens cited and mapped in his Fig. 54, Armstrong clearly indicates that *Z. furfuracea* subsp. *furfuracea* is endemic to north-eastern NSW, as also stated by Armstrong and Harden (2002), yet in his discussion on distribution he states that it is “distributed from the Wide Bay District of south-eastern Queensland south to the Northern Coast and Tablelands and the Central Coast of NSW, north from the Wyong district. At Cedar Creek, in south-eastern Queensland, the taxon forms shrubs up to 1 m high”. Yet he has clearly annotated (at BRI) and cites specimens from Cedar Creek under his *Z. furfuracea* subsp. *euthadenia*.

Distribution and habitat: *Zieria furfuracea* subsp. *euthadenia* is endemic to Qld and has been recorded from a number of populations centred in the Kin Kin area, as well as a more northerly disjunct occurrence at Mt Woocoo within the Southeast Queensland bioregion (**Map 9**). The subspecies has been collected in open eucalypt forest or shrubland, in association with a number of different canopy species, including *Eucalyptus grandis*, *E. helidonica*, *E. propinqua*, *Syncarpia glomulifera*, *Corymbia citriodora*, *C. intermedia* and *Leptospermum* species. At Mt Woocoo the species occurs on sandstone.

Phenology: Flowers have been collected in January, March to June, August, September and December, and fruits in April, May, August, September and December.

Conservation status: Armstrong (2002: 363) listed this taxon as 2K and stated that "the conservation status cannot be reliably determined". Recent collections from its area of distribution indicate that this subspecies is reasonably common with populations in Dularcha and Glasshouse Mountains N.P.s, as well as a number of state forests. A conservation status of **Least Concern** (IUCN 2001) is recommended.

16b. Zieria furfuracea subsp. **gymnocarpa** J.A.Armstr., *Austral. Syst. Bot.* 15: 363 (2002). **Type:** Queensland. Moreton District: Belmont, 10 September 1887, *J.H.Simmonds s.n.* (holo: BRI [AQ318534]).

Zieria furfuracea subsp. (Belmont Scrub Anon. AQ152898); Forster (2002: 181)

Illustrations: Armstrong (2002: 364); Logan River Branch SGAP (QLD Region) Inc. (2005: 175).

Additional specimens examined: **Queensland.** Moreton District: Belmont, RP10826, entrance to Greendale way near intersection with Weekes road, Mar 1997, *Leiper s.n.* (BRI [AQ654847], MEL, NSW); Belmont, Greendale way, Aug 2002, *Leiper s.n.* (BRI [AQ732223]); Belmont Hills Bushland complex, off Greendale way, Sep 2002, *Leiper s.n.* (BRI [AQ764008]); Belmont, 126 Scrub road, Mar 1997, *Leiper s.n.* (BRI [AQ654846], MEL); Brisbane City Council land, Belmont, Apr 1997, *Leiper s.n.* (BRI [AQ653837], MEL); Mt Petrie road, Belmont, Apr 1997, *Leiper s.n.* (BRI [AQ653835], NSW); Belmont Hills Bushland complex, off Greendale way, Sep 2002, *Leiper s.n.* (BRI [AQ764009]); Belmont Hills Bushland Reserve, Sep 2002, *Leiper s.n.* (BRI [AQ764012, AQ764014, AQ764015]); Belmont Hills Bushland Reserve, Spider Gully, Sep 2002, *Leiper s.n.* (BRI [AQ764011]); regrowth area adjacent to Gateway motorway at Belmont, Oct 2002, *Leiper s.n.* (BRI [AQ770316]); Gateway Bridge motorway near Belmont Hill, Feb 2000, *Leiper s.n.* (BRI [AQ667718]); South facing gully below summit of Mt Petrie, Nov 2002, *Leiper s.n.* (BRI [AQ770760]); BCC Reserve, Mt Petrie road, Belmont, Oct 2002, *Leiper s.n.* (BRI [AQ764010]); bank of drain between Gateway motorway & Mt Petrie road, Oct 2002, *Leiper s.n.* (BRI [AQ770317, AQ770314]).

Notes: This subspecies is perhaps most easily recognised by the weakly crenate leaf margin.

Distribution and habitat: *Zieria furfuracea* subsp. *gymnocarpa* is endemic to Qld and restricted to a small area in the Brisbane suburb of Belmont within the Southeast Queensland bioregion (**Map 9**). It occurs as an understorey shrub in an open forest that includes *Acacia disparrima, Allocasuarina littoralis, Eucalyptus carnea, E. crebra, E. propinqua, E. microcorys, Corymbia intermedia* and *Lophostemon confertus*. Plants have also been collected in regrowth vegetation dominated by *Megathyrsus maximus* var. *pubiglumis* (guinea grass) and *Acacia disparrima*.

Phenology: Flowers have been collected from February to April and August to November, and fruits from February to April, and in September and October.

Conservation status: This taxon was incorrectly stated by Armstrong (2002) to be extinct, although it had been rediscovered in 1997 by Glenn Leiper. It is currently listed as **Endangered** in Qld (*NCA* 1994). A detailed survey of the known populations of this taxon by Leiper (2002) indicates that there are approximately 8900 individuals in seven populations. Direct threats to the populations of this subspecies are road maintenance on the Gateway motorway, destruction of remaining bushland remnants, weed invasion and changed fire regimes resulting from weeds and pyromaniacs.

17. Zieria graniticola J.A.Armstr. ex Duretto & P.I.Forst., **species nova** a *Z. aspalathoide* A.Cunn. ex Benth. differt caulibus foliisque clare glandulari-verrucosis (adversum indistincte glandulari-verrucosa), sepalorum indumento stellato (in illa plerumque piloso) et petiolo majore (1–3 mm adversum 0–1 mm longitudine) differt. **Typus:** Queensland. Darling Downs District: Mt Janet road, Passchendale State Forest, NW of Stanthorpe, 28°33′S, 151°48′E, 4 October 1997, *A.R.Bean 12477* (holo: BRI; iso: MEL 2095863).

Zieria sp. (Amiens L.Pedley 1518); Forster (1997b: 188; 2007: 183).

Shrub to 1 m tall forming a densely compact bush. Stems erect, wiry; branches weakly glandular verrucose, with a dense indumentum of mainly simple and bifid (though also with trifid and stellate) hairs between the very faint decurrent leaf bases, otherwise glabrous or pilose (*Halford Q2330*). Leaves palmately trifoliolate; petioles 1–3 mm long, weakly glandular verrucose, adaxial surfaces pilose, abaxial surfaces glabrescent or pilose (*Halford Q2330*); terminal leaflets narrow elliptic to narrow oblanceolate, 6–18 × 1.5–4 mm, tips acute, margins recurved to revolute, slightly glandular dentate, midrib raised abaxially and weakly to strongly glandular verrucose, both surfaces glabrescent with hairs on midvein and at tips or sparsely pilose (*Halford Q2330*), with tufts of simple hairs at join of leaflets and petioles; lateral leaflets similar to terminal leaflets though usually slightly smaller. Inflorescence axillary, shorter or longer than the subtending leaves, 1–3 (–9 Amiens)-flowered, weakly glandular verrucose, pilose with hairs concentrated between decurrent bract bases; peduncle 0.5–2.5 (–13 Amiens) mm long; bracts narrow-elliptic to narrow-lanceolate, persistent, 1–5 mm long; pedicels 1.5–5 mm long, with a moderately dense stellate indumentum. Sepals ovate-deltate, 1–1.5 × 0.9–1 mm, valvate in bud, glandular but not glandular verrucose, tips acute to slightly acuminate, adaxial surfaces with a sparse to moderately dense simple and stellate indumentum, abaxial surfaces with a sparse to moderately dense stellate indumentum. Petals elliptic, (2.5– *Halford Q2330*) 3.5–4.5 × 2.2–2.5 mm, pale pink, valvate or slightly imbricate in bud, not obviously glandular, both surfaces with a moderately dense to dense indumentum of mainly stellate hairs. Staminal filaments *c.* 1.2 mm long, with scattered stellate and simple hairs distally, very slightly glandular verrucose at apex; anthers *c.* 0.6 mm long, apiculum minute. Gynoecium glabrous or sparsely pilose (*Halford Q2330*). Cocci [mature not observed] 4–4.5 mm × *c.* 2.5 mm, slightly glandular verrucose, glabrous or sparsely pilose dorsally (*Halford Q2330*), base of style sometimes persistent forming a minute apical apiculum. Seeds not observed. **Fig. 9.**

***Additional specimens examined*:** **Queensland.** Darling Downs District: Messines via Cottonvale, Sep 1930, *Greener s.n.* (BRI [AQ 531208]); Bapaume via Cottonvale, Oct 1930, *Horn 15* (BRI); Amiens, 28°35'S, 151°48'E, Oct 1966, *Harslett s.n.* (CANB 559713); 'Mountain View', Amiens, Oct 1983, *Harslett s.n.* (BRI [AQ 393825], CANB [CBG8905597]); *loc. cit.*, Oct 1966, *Frazier s.n.* (NSW 98643); Amiens via Stanthorpe, 28°35'S, 151°48'E, Aug 1983, *Harslett s.n.* (BRI [AQ 349637 – 2 sheets]); Amiens WNW of Stanthorpe, Oct 1963, *Harslett sub Pedley 1518* (BRI, CANB); *c.* 1 mile [1.7 km] W of Jollys Falls, 5 miles [8.3 km] N of Stanthorpe, Oct 1963, *Pedley 1534* (BRI, HO); 15.7 km SW of Stanthorpe, Portion 87, Stalling lane, 28°44'S, 151°48'E, Nov 1994, *Halford Q2330* (BRI, MEL); 6.5 km W of Glen Aplin, Portion 87, Stalling lane, Nov 1994, *Halford Q2346* (BRI).

***Notes*:** *Zieria graniticola* was a manuscript name used by J.A.Armstrong on many herbarium specimens and not subsequently published (see Armstrong 2002). Under *Z. aspalathoides*, in his published account (Armstrong 2002), he refers to a form from south-eastern Qld (Amiens, Girraween N.P., Wyberba, Mt Norman) and the Northern Tablelands of NSW (Silent Grove, Tenterfield) with "attenuate calyx lobes, short compact inflorescences generally shorter than the subtending leaves and younger branches with very noticeable allotrichous pubescence" which appears to be a local variant of *Z. aspalathoides* (see also discussion under of *Z. aspalathoides* subsp. *aspalathoides*). Under *Z. laevigata* he discusses a form from near Wallangarra and Wyberba that he suggested was a stabilised hybrid between *Z. laevigata* and *Z. aspalathoides.* These plants are similar to *Z. graniticola* in leaf shape but are tomentose on the abaxial surface of the leaves as is *Z. laevigata* (see also discussion under that species) and warrant further investigation.

Collections of *Zieria graniticola* from the Cottonvale/Amiens area (north of Stanthorpe) are fairly uniform in general appearance. The specimens collected south of Stanthorpe (*Halford Q2330, Q2346*) differ from these by being sparsely pilose all over the stems (versus hairs confined to area between faintly decurrent leaf bases) and leaves (versus glabrescent), having smaller leaves and petals (2.5–3.2 mm long versus 3.5–4.5 mm long) and sparsely pilose cocci (versus glabrous). *Halford Q2330* and *Q2346* look similar to *Z.* sp. 'Cathedral Rock' (Williams 95303) as described in Armstrong and Harden (2002) which is found in the Cathedral Rock N.P. (NSW) (*Williams 95303*, NSW 433121) and

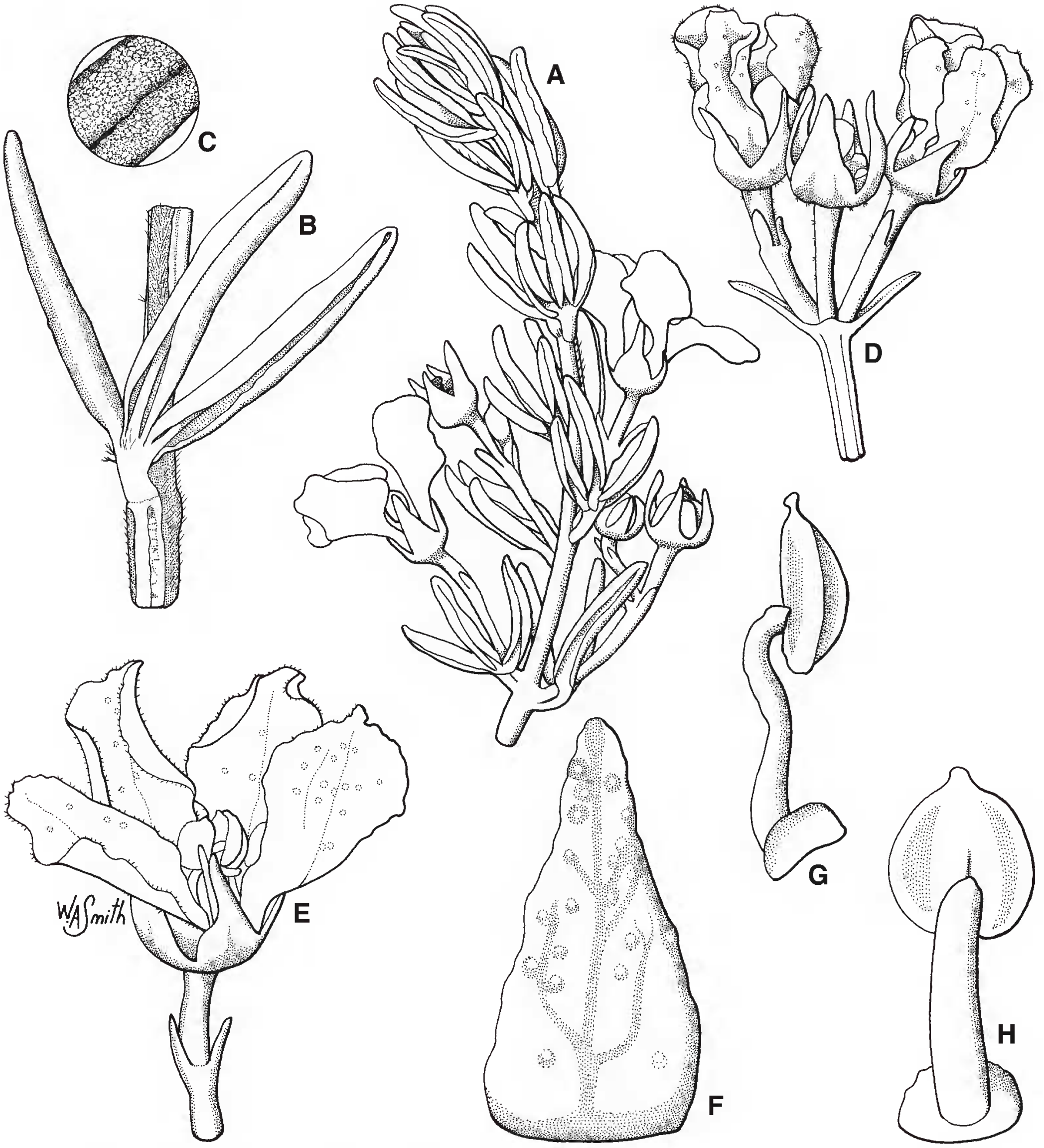


Fig. 9. ***Zieria graniticola.*** A. branch with several flowering inflorescences × 4. B. stem node with abaxial view of leaf × 8. C. detail of indumentum on abaxial surface of leaflet × 20. D. inflorescence with flowers and immature fruit × 6. E. flower × 6. F. abaxial view of sepal × 20. G–H. views of stamens × 20. A–E, G–H from *Harslett s.n.* (BRI [AQ393826]); F from *Halford Q2346* (BRI). Del. W. Smith.

Howell area (NSW) (*Williams s.n.* NSW 651474, *Williams s.n.* NSW 651470). *Z.* sp. 'Cathedral Rock' (Williams 95303) has leaflets that are noticeably more glandular tuberculate and in itself is very poorly known.

Zieria graniticola appears to be sympatric with *Z. aspalathoides* at Amiens and many of J. Harslett's collections from there are mixed collections, with different species having the same collection information at different herbaria. Herbarium sheet numbers are cited for these collections.

***Distribution and habitat*:** *Zieria graniticola* is endemic to Qld and confined to two disjunct areas north and south of Stanthorpe within the New England Tableland bioregion (**Map 9**). It is found growing in sandy soil over granite. In Passchendale S.F. it is found in an open forest of *Eucalyptus andrewsii* and *E. banksii* with a shrubby understorey. Some collections have also been from rocky outcrops.

Phenology: Flowers have been collected from August to November, and fruit in October and November.

Conservation status: Collector's notes indicate that this species is rare in the Passchendale S.F. but is considered common at Stallen Lane (south-west of Stanthorpe). *Zieria graniticola* has a very restricted distribution and does not appear to be found in any conservation reserve. It can be assessed as **Endangered** on the basis of criteria B2a,b(i-v) (IUCN 2001). Surveys are required to ascertain the size and extent of the known populations and the area of occupancy.

Etymology: The name refers to the granite substrate that this species grows on.

18. Zieria hydroscopica Duretto & P.I.Forst. **species nova** a *Z. smithii* Jacks. foliolis in pagina adaxiali pilosis (adversum foliola glabra vel glabrescentia vel pilis dispersis stellatis), et in ramis pilis stellatis radiis longioribus (radii longitudine usque ad 0.5 mm adversum ad *c.* 0.1 mm); et a *Z. boolbunda* Duretto & P.I.Forst. foliis basi non vel tantum leviter decurrentibus (adversum folia manifeste decurrentia) differt. **Typus:** Queensland. Burnett District: Rocky Gorge Waterhole, Coominglah S.F., west of Monto, 24°53′S, 150°56′E, 16 September 1995, *A.R.Bean 8959 & P.Robbins* (holo: BRI; iso: MEL 2095862).

Zieria sp. (Coominglah A.R.Bean 8959); Forster (2002: 181; 2007: 183)

Shrub to 50 cm tall, forming an open compact bush. Stems erect, wiry; young branches without or with slightly decurrent leaf bases, slightly glandular verrucose, with a sparse indumentum of stellate hairs that is denser between the decurrent leaf bases, becoming glabrescent with age. Leaves palmately trifoliolate; petioles 8–11 mm long, slightly glandular verrucose, with a sparse indumentum of stellate and simple hairs; terminal leaflets narrow elliptic to narrow lanceolate, 20–33 × 4–6 mm, tips obtuse to acute, margins flat to recurved or slightly revolute [though possibly only on drying], midribs strongly raised abaxially, very slightly glandular verrucose, secondary veins raised abaxially, adaxial surfaces with a sparse, pilose indumentum of mainly simple and bifid hairs, abaxial surfaces with a sparse indumentum of simple, bifid and stellate hairs, lateral leaflets similar to terminal leaflets though they can be shorter or longer. Inflorescence axillary, shorter than the subtending leaf, 8–25+-flowered, not or slightly glandular verrucose, with a sparse simple and stellate indumentum; peduncle 2–8 mm long; bracts scale or leaf like, lower ones mostly deciduous though upper ones persistent, 1–4.5 mm long; pedicels 1–3.5 mm long, not or slightly glandular verrucose, with a moderately dense stellate tomentum. Sepals deltate, *c.* 1 mm long and wide, valvate or slightly imbricate in bud, slightly glandular verrucose, tips acute, adaxial surfaces with scattered appressed simple hairs, abaxial surfaces with a moderately dense stellate indumentum. Petals narrow-elliptic, 2.1–2.5 × 1.2–1.5 mm, white, imbricate in bud, not obviously glandular, both surfaces densely stellate-tomentose. Staminal filaments *c.* 1 mm long, with minute, simple hairs along length, weakly glandular verrucose near tip; anthers *c.* 0.5 mm long, apiculum absent. Ovary glabrous; style glabrous or simple glabrescent. Cocci [only very immature seen] with scattered stellate hairs. Seeds not observed. **Fig. 10.**

Additional specimen examined: Burnett District: Coominglah S.F., Boolgalgopal Creek, The Rock Hole, 24°53′S 150°57′E, Nov 1993, *Telford 11900* (BRI, CANB, HO, NSW *n.v.*).

Notes: *Zieria hydroscopica* is similar to *Z. smithii* but differs in having leaflets that are pilose on the adaxial surface (versus glabrous, glabrescent or with scattered stellate hairs), and having stellate hairs on the branches with longer rays (0.5 mm long versus to *c.* 0.1 mm long). It differs from *Z. boolbunda* in having leaf bases that are not or only slightly decurrent versus obviously decurrent.

Distribution and habitat: The taxon is known only from Coominglah S.F. near Monto in

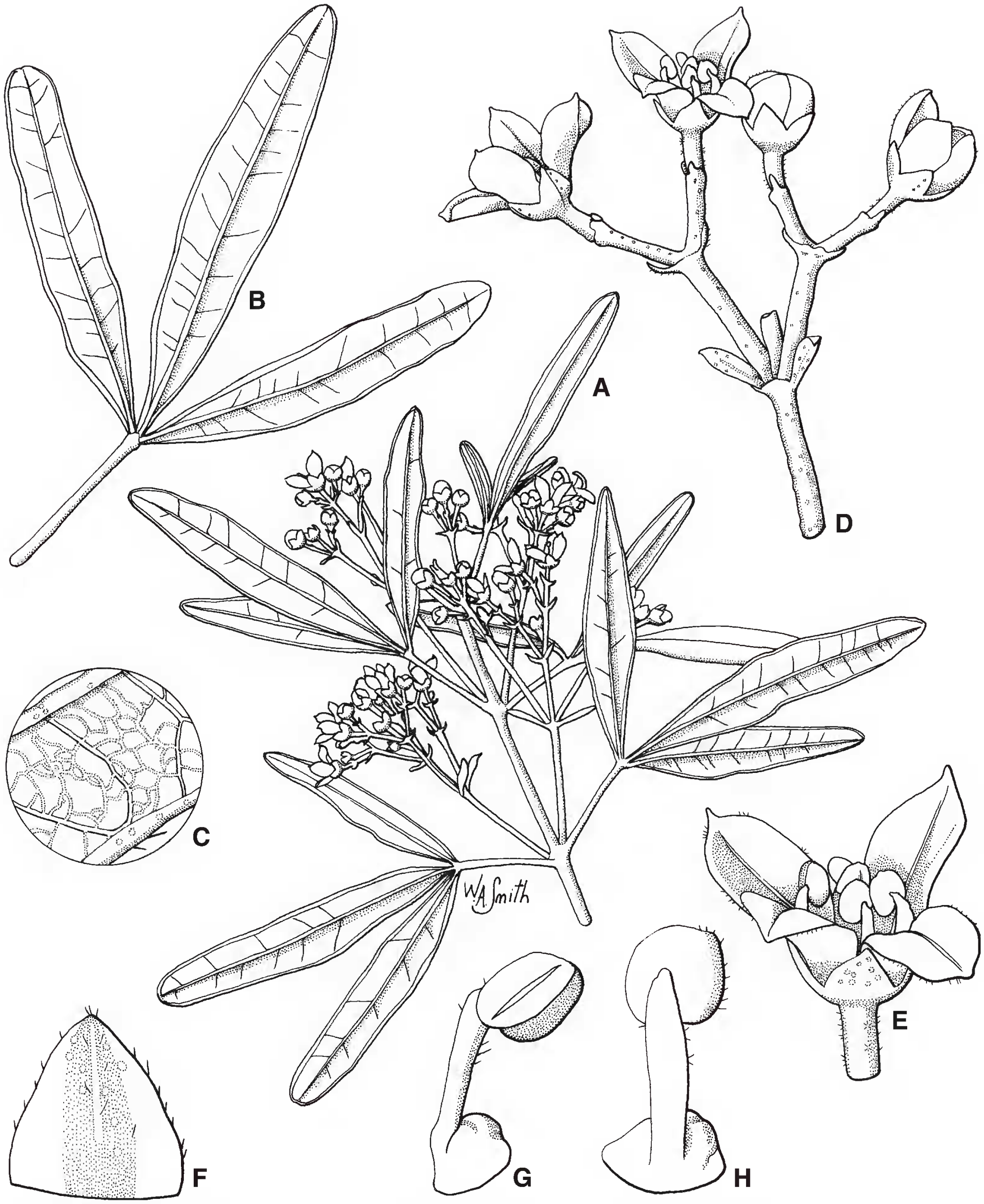


Fig. 10. ***Zieria hydroscopica.*** A. branch with several flowering inflorescences × 1.5. B. abaxial view of leaf × 2. C. detail of indumentum on abaxial surface of leaflet × 8. D. inflorescence with bud and flowers × 4. E. flower × 8. F. abaxial view of sepal × 20. G–H. views of stamens × 20. All from *Bean 8959* (BRI). Del. W. Smith.

the Brigalow Belt bioregion (**Map 12**). The specimen from Rocky Gorge (*Bean 8959 & P.Robbins*) was collected from a rocky creekbed with *Corymbia trachyphloia* and *Lophostemon suaveolens*, while the specimen from Boolgalgopal Creek (*Telford 11900*) was collected from an open forest of *Eucalyptus acmenoides*, *Angophora leiocarpa*, *Allocasuarina littoralis* and *Dodonaea triangularis*.

Phenology: Flowers have been collected in September.

Conservation status: Both collectors noted that few plants were seen. On the basis of known data, this species can be assessed as **Endangered** on the criteria of B2a, D (IUCN 2001). The Coominglah Range is notable for the presence of the endemic *Pomaderris coomingalensis* N.G.Walsh & Coates and the near endemics (a significant number of known populations) *Boronia palasepala* Duretto, *Grevillea hockingsii* Molyneux & Olde and *Solanum lythrocarpum* A.R.Bean.

Eymology: The specific epithet is derived from the Greek *hydro-* (water) and *scopic* (watcher) and alludes to the populations of this plant occurring near water holes.

19. Zieria inexpectata Duretto & P.I.Forst. **species nova** a *Z. aspalathoide* A.Cunn. ex Benth. caulibus foliisque glandulari-verrucosis (adversum indistincte glandulari-verrucosa) et petiolis longioribus (1–1.5 adversum 0–1 mm longitudine) differt. **Typus:** Queensland. Burnett District: 'Bronte', 9 km SW of Gayndah, 25°43′S, 151°30′E, 14 September 1999, *P.I.Forster PIF24851, M.F.Duretto & P.Grimshaw* (holo: BRI; iso: AD, K, MEL 306443, NSW).

Shrub to 50 cm tall forming a densely compact bush. Stems erect, wiry; branches without decurrent leaf bases, weakly glandular verrucose, pilose with simple, bifid and few trifid hairs. Leaves palmately trifoliolate (though first pair of leaves on secondary shoots simple), weakly glandular verrucose; petioles 1–1.5 mm long, glabrescent to sparsely hairy; terminal leaflets narrow elliptic to narrow oblanceolate, 4–6.5 (–9) × 0.7–2.5 mm, tips obtuse, margins recurved to revolute, glandular dentate, midribs raised abaxially, adaxial surfaces glabrescent to sparsely pilose, abaxial surfaces glabrescent with few simple hairs, especially along midribs, as well as tufts of simple hairs at join of leaflets and petioles; lateral leaflets similar to terminal leaflets. Inflorescence axillary, longer than the subtending leaf, 1–12-flowered, weakly glandular verrucose, pilose with hairs concentrated between decurrent bract bases; peduncle 4–11 mm long; bracts narrow-elliptic to narrow-lanceolate, persistent, 1–2 mm long; secondary peduncles 3–4 mm long; pedicels 2–3 mm long. Sepals ovate-deltate, 1–2 × 0.7–1.5 mm, valvate in bud, glandular but not glandular verrucose, tips acute, adaxial surfaces puberulous, abaxial surfaces with scattered stellate hairs concentrated at base. Petals elliptic, 2–3 × 1.5–2.5 mm, white, valvate in bud, not obviously glandular, adaxial surfaces with a sparse indumentum of simple and stellate hairs, abaxial surfaces with a dense indumentum of simple and stellate hairs. Staminal filaments 1–1.2 mm long, with scattered stellate and simple hairs, slightly glandular verrucose at apex; anthers *c.* 0.5 mm long, apiculum minute. Gynoecium glabrous. Cocci *c.* 3.5 × 2 mm, slightly glandular verrucose, glabrous, base of style sometimes persistent forming a minute apical apiculum. Seeds not observed. **Fig. 11.**

Additional specimens examined: **Queensland.** Burnett District: Aranbanga Creek catchment area, 'Bronte', Sep 1999, *Duretto 1318, Forster & Grimshaw* (BRI, MEL); 'Bronte', 9 km WSW of Gayndah, Jun 2000, *Forster PIF25857* (BRI, MEL); S.F. 146, SE of Proston, 26°14′S, 151°38′E, Mar 1996, *Bean 11818* (BRI, MEL, NSW); Compartment 21, S.F. 12, near Wondai, 26°21′S, 151°58′E, Sep 1996, *Bean 10822* (BRI, MEL, NSW).

Notes: *Zieria inexpectata* is superficially similar to the widespread *Z. aspalathoides*, but can be distinguished from that species in the stems and leaves being glandular verrucose (versus not obviously glandular verrucose) and the leaf petioles being greater than 1 mm long (versus subsessile to 1 mm long). Material from southern parts of the species range, eg. S.F. 12 (*Bean 10822*) and from near Proston (*Bean 11818*), have smaller floral parts than material from the type locality at 'Bronte'. There are too few collections to determine if this variation warrants taxonomic recognition.

Distribution and habitat: *Zieria inexpectata* is endemic to Qld within the Brigalow Belt and Southeast Queensland bioregions (**Map 9**) where it is known from a few localities in the central Burnett District: 'Bronte' south west of Gayndah, S.F. 146 near Proston, and S.F. 12 near Wondai. At 'Bronte', *Z. inexpectata* occurs in woodland dominated by *Corymbia trachyphloia*, *C. citriodora*, *Lysicarpus angustifolius* and *Acacia sparsiflora* on a

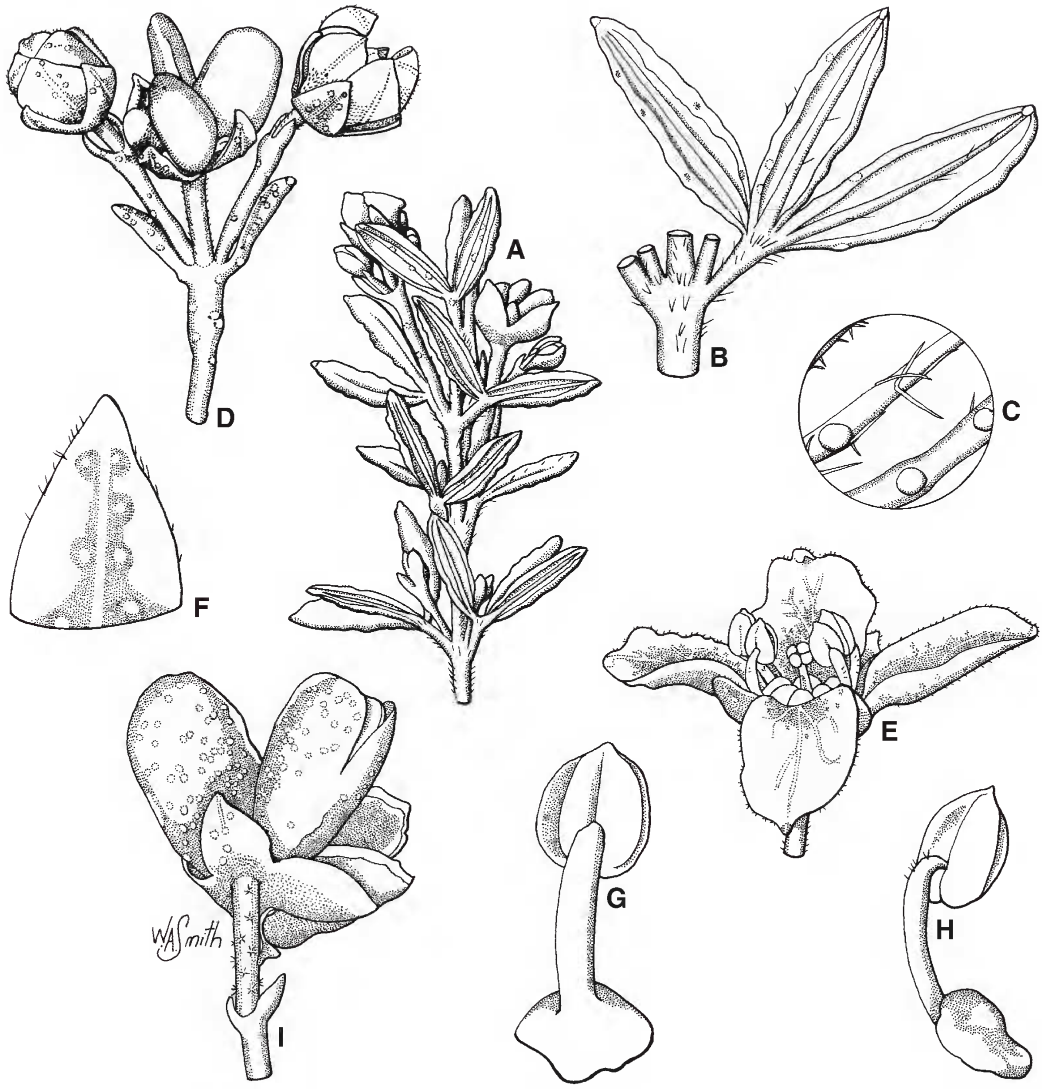


Fig. 11. ***Zieria inexpectata.*** A. branch with several flowering inflorescences × 4. B. stem node with abaxial view of leaf × 8. C. detail of indumentum on abaxial surface of leaflet × 20. D. inflorescence with bud, flower and immature fruit × 6. E. flower × 8. F. abaxial view of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. All from *Forster PIF24851* (BRI). Del. W. Smith.

duricrust jumpup. Other associated species include *Hovea planifolia*, *Boronia grimshawii*, *Podolobium ilicifolium*, *Logania albiflora*, *Alphitonia excelsa* and *Entolasia stricta*. At S.F. 12 and S.F. 146 the species is found in an open forest of *C. citriodora* and *Eucalyptus* spp., or *C. watsoniana* and *Lysicarpus angustifolius*. Invariably *Z. inexpectata* is found growing in sandy soil.

***Phenology*:** Flowers have been collected from March to November, and fruit from June to November.

***Conservation status*:** Several hundred plants are present at the type locality. Here, the species co-occurs with two locally endemic species: *Boronia grimshawii* Duretto, and an undescribed species of *Acacia*. The type locality is on private land that is bisected by a gazetted road. At S.F. 12 (near Wondai) the species is not common while at S.F. 146 (near Proston) the species was reported to be common (collector's notes). An appropriate conservation coding is **Endangered** under the criteria of B2a,b(iii),(v), C2a (IUCN 2001). The total area of known occupancy is less than 20 ha and perceived threats are grazing by stock, fire and deliberate destruction of plants.

***Etymology*:** The specific epithet alludes to the collection of this undescribed *inex(s)pectatus* (unexpected), species while investigating the population of the newly discovered, and then undescribed, *Boronia grimshawii* at the type locality.

20. Zieria insularis Duretto & P.I.Forst., **species nova** a *Z. smithii* Jacks. habitu debili, foliolis parvis praeditis indumento praecipue pilorum simplicium bifidorumque (in illa stellatorum) in pagina abaxiali differt. **Typus:** Queensland. Cook District: State Forest 144, Mt Windsor Tableland, 16°15′S, 145°02′E, 11 July 1995, *P.I.Forster PIF17246 & S.J.Figg* (holo: BRI; iso: AD, DNA, K, MEL, NSW, QRS).

Zieria smithii subsp. (SF144 B.Gray 428); Forster (2002: 181).

Shrub to 2 m tall, forming an open straggly bush. Stems erect to decumbent, wiry to spindly; branches with faintly decurrent leaf bases, not glandular verrucose, pilose with mainly simple and bifid hairs, hairs denser between leaf decurrencies. Leaves palmately trifoliolate; petioles 2–4 mm long, with a sparse indumentum of simple and bifid hairs; terminal leaflets narrow-elliptic, elliptic, or obovate, 8–21 × 2–6 mm, laminae weakly pellucid gland dotted, not glandular verrucose, tips acute to obtuse, margins slightly crenulate, ± flat, midribs raised abaxially, secondary veins obscure, adaxial surfaces glabrescent with few simple hairs along midrib or with a sparse indumentum of simple and bifid hairs, abaxial surfaces with a sparse indumentum of simple and bifid hairs though a few stellate stellate hairs sometimes also present; lateral leaflets similar to terminal leaflets though usually slightly smaller. Inflorescence axillary, 1–several per axil, some at least longer than the subtending leaf, 1–several-flowered, not obviously glandular, sparsely pilose with simple and bifid hairs; peduncle 5–20 mm long; bracts linear, persistent, 0.4–2 mm long; secondary peduncles 2–5 mm long; pedicels 1–2 mm long. Sepals deltate, 1–1.1 mm long and wide, valvate in bud, not obviously glandular, tips acute, adaxial surfaces sparsely pilose, abaxial surfaces with a sparse indumentum of stellate hairs. Petals lanceolate-elliptic, *c.* 3 × 1.5 mm, white, valvate in bud, not obviously glandular, both surfaces with a sparse to dense stellate indumentum. Staminal filaments 1–1.2 mm long, glabrous or with the occasional hair, eglandular; anthers 0.6–0.7 mm long, apiculum absent or small and recurved. Gynoecium glabrous. Cocci 3–4 × 1.5–2 mm, not glandular verrucose, glabrous or with few hairs, base of style sometimes persistent forming a minute apical apiculum. Mature seeds not observed. **Fig. 12.**

***Additional collections examined*:** **Queensland.** Cook District: Mt Windsor, Granite Dome, Jun 1982, *Hind 3168* (NSW); Mt Windsor forestry camp, on Spencers Creek, 16°15′S, 145°07′E, Aug 1998, *Hind 5684 & D'Aubert* (HO, NSW); S.F.R. 144, 16°16′S, 145°05′E, Mar 1977, *Gray 428* (BRI, CANB); Daintree N.P., Little Daintree River, 16°21′S, 145°10′E, May 1998, *Forster PIF22796 et al.* (AD, BRI, MEL, QRS); Daintree N.P., northwest of Black Mountain, 16°22′S, 145°11′E, May 1998, *Forster PIF22873 et al.* (AD, BRI, K, MEL, NSW).

***Notes*:** *Zieria insularis* appears to be related to *Z. smithii* but has a weaker habit, smaller leaves and an indumentum of mainly simple and bifid hairs (versus stellate) on the abaxial surface of the leaflets.

***Distribution and habitat*:** The species is endemic to the Wet Tropics bioregion of north-eastern Qld where it is known from the Mt Windsor Tableland and the Daintree N.P. near Black Mountain (**Map 6**). On the Mt Windsor Tableland it has been collected from small 'islands' of exposed rocky areas of granite surrounded by rainforest or in open forest dominated by *Syncarpia glomulifera*, *Callitris macleayanus*, *Croton insularis* and *Leptospermum amboinense* on granite near watercourses. In the Daintree N.P. it has been found in two different communities: an open forest of *Eucalyptus reducta* and *Syncarpia glomulifera* on a granite ridge; and on granite outcrops in a creek with scattered *Callistemon viminalis* and *Lophostemon confertus*.

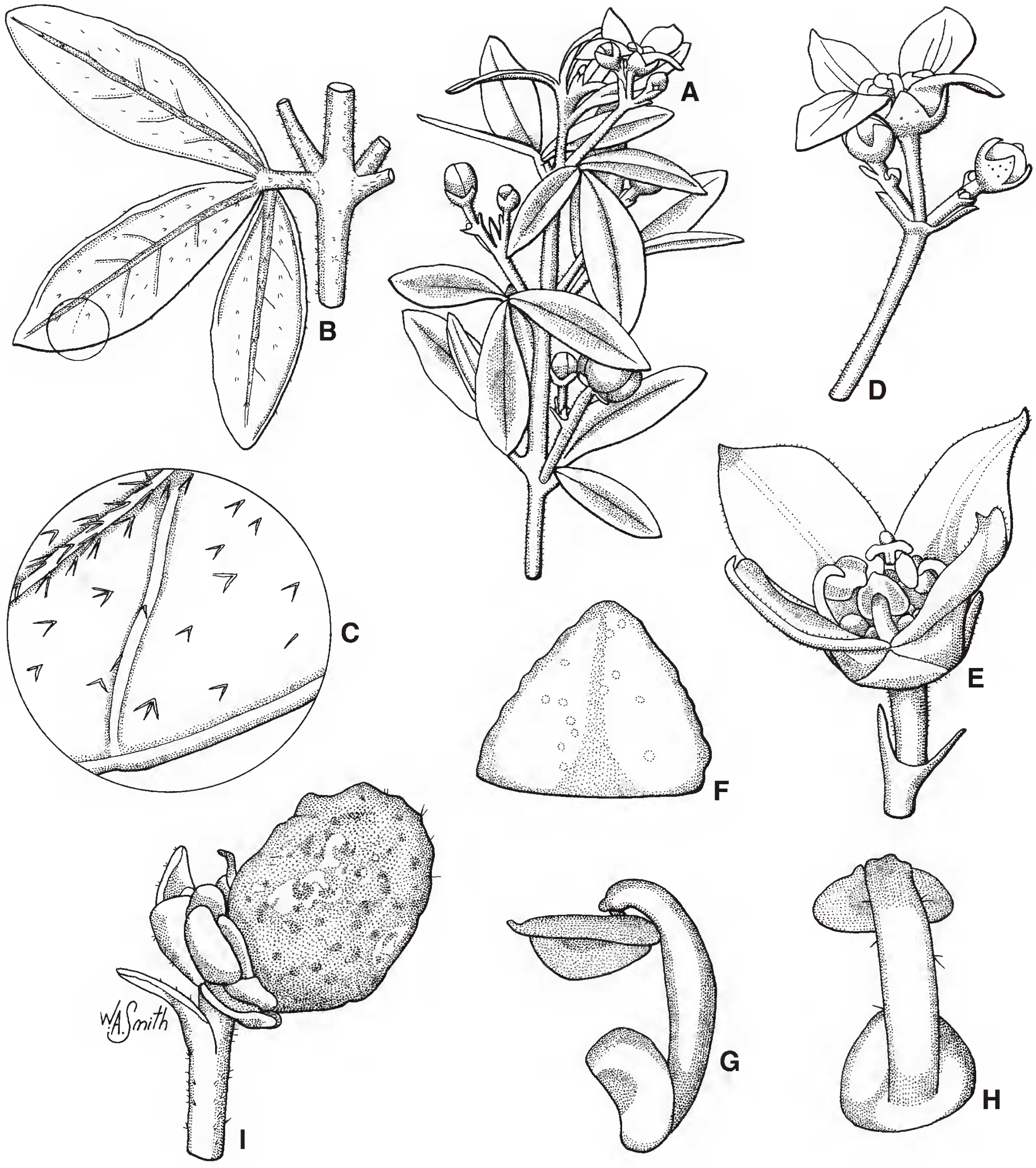


Fig. 12. ***Zieria insularis.*** A. branch with several flowering inflorescences × 2. B. stem node with abaxial view of leaf × 3. C. detail of indumentum on abaxial surface of leaflet × 16. D. inflorescence with buds and flower × 4. E. flower × 8. F. abaxial view of sepal × 20. G–H. views of stamens × 20. I. mature fruit with coccus × 8. All from *Forster PIF17246* (BRI). Del. W. Smith.

Usually the plants are found in saxicolous mat-forming vegetation comprised largely of monocotyledonous plants.

***Phenology*:** Flowers and fruit have been collected from January to July.

***Conservation status*:** This species can be locally common or rare, depending on the fire history of the locality. It has been collected only in National Parks and Forest Reserves; however, the areas of suitable habitat are relatively rare within a greater mosaic of either rainforest or fire prone vegetation. Other localised endemics that co-occur with *Zieria insularis* include *Plectranthus fasciculatus* P.I.Forst. and *Stylidium confertum* A.R.Bean.

The conservation status of this species can be assessed as **Near Threatened** on the basis of criterion D (IUCN 2001). Surveys are required to ascertain the number of populations, number of individuals and the area of occupancy. Perceived threats are invasions of the isolated granite outcrops by weeds, and too frequent fires.

***Etymology*:** The specific epithet is derived from the Latin adjective *insularis* (pertaining to islands) and refers to the occurrence of this species on islands of rock in a sea of rainforest.

21. Zieria laevigata Bonpl., *Descr. Pl. Malmaison* 64 (1815). **Type:** New South Wales. Central Tablelands: On rocky situations on the verge of Regent's Glen, Blue Mountains, 4 October 1822, *A.Cunningham 27* (neo [designated by Armstrong (2002: 378)]: K 347900 [images BRI, HO 534661]; isoneo: BRI [AQ318539]).

Zieria laevigata subsp. (Wyberba T.L.Ryan 37); Forster (2002: 181).

***Illustrations*:** Williams (1999: 387); Armstrong (2002: 380, 381).

***Additional selected specimens examined*:** Queensland. Darling Downs District: Amiens, 28°35′S, 151°48′E, Dec 1952, *Gordon DMG269* (BRI); Lyra, Nov 1959, *Blake 21096* (BRI); S.F. 263, near Amiens, Sep 1974, *McDonald 381* (BRI); on track to The Junction, Bald Rock Creek, Girraween N.P., 28°50′S, 151°55′E, Oct 2001, *Duretto 1429 & Jensz* (BRI, HO, MEL); Portion 90, Wyberba, 28°50′S, 151°54′E, Aug 1995, *Forster PIF17596 & Figg* (BRI, MEL); Upper reaches of Bald Rock Creek, Girraween N.P., 28°50′S, 151°58′E, Sep 1993, *Bean 6370 & Forster* (BRI, NSW).

***Notes*:** In 1992 Armstrong annotated some Darling Downs specimens of this species as a new subspecies; however, the proposed name was not published in the monograph (Armstrong 2002). He did comment that the collections may represent "a stabilised hybrid between *Z. laevigata* and *Z. aspalathoides*". This form (e.g. *Blake 21096*, *23715A*; *Clemens* AQ530716; *Duretto 1429 & Jensz*; *Ryan 37*; *Schindler* AQ531220) can be distinguished from typical *Z. laevigata* (e.g. *Gordon DMG269*) by the stellate pubescence on the stems (versus glabrous), and from *Z. graniticola* (described above) by the dense indumentum on the abaxial surface of the leaves (versus glabrous) and may represent an undescribed taxon. Further field and laboratory studies are required to ascertain the taxonomic status of this form.

***Distribution and habitat*:** This species is widespread from southern NSW through to the 'Granite Belt' near Stanthorpe in Qld within the New England Tableland bioregion (**Map 7**). Plants grow in shrubland or heathland on granite pavement, often in association with *Eucalyptus prava*.

***Phenology*:** Flowers have been collected from August to December, and fruit from November to December.

***Conservation status*:** *Zieria laevigata* is restricted in its Qld occurrence; however, it is widespread and common over its total range. In Qld it is present in Girraween N.P. An appropriate conservation status is **Least Concern** (IUCN 2001).

22. Zieria laxiflora (Benth.) Domin, *Repert. Spec. Nov. Regni. Veg.* 12: 132 (1913); *Zieria laevigata* var. *laxiflora* Benth., *Fl. Austral.* 1: 304 (1863). **Type:** Queensland. Moreton District: Moreton Island, August 1855, *F.Mueller s.n.* (lecto [designated by Armstrong (2002: 388)]: K 347897 [images BRI, HO 534654]).

***Illustrations*:** Williams (1979: 281); Armstrong (2002: 386, 387); Haslam (2004: 64); Logan River Branch SGAP (QLD Region) Inc. (2005: 121).

***Corrections and additions to description given in Armstrong (2002)*:** Sepals 1.2–1.7 mm long, shorter than petals. Petals 3–4.5 mm long. Staminal filaments usually glabrous, rarely sparsely hirsute with simple and stellate hairs (e.g. *Batianoff 461 & McDonald*; *Fell 4535*).

***Additional selected specimens examined*:** **Queensland.** Port Curtis District: Port Clinton, 60 km N of Yeppoon, 22°30′S, 150°43′E, Aug 1993, *Sharpe 5420 & Thomas* (BRI); 4.5 km NW of Five Rocks, May 1996, *Fell 4535* (BRI); Shoalwater Bay, Dismal Sector, 22°43′S, 150°45′E, Jun 1999, *Brushe JB1934 & Power* (BRI); Emu Park, 15 km SE of Yeppoon, 23°15′S, 150°49′E, Jul 1977, *Batianoff 302 & McDonald* (BRI); Deepwater Creek N.P., on track to Deepwater Creek, 24°21′S, 151°58′E, Sep 1992, *Sharpe 5171* (BRI); 2 km W of Rules Beach, near Baffle Creek, NW of Bundaberg, 24°29′S, 152°00′E, Oct 1996, *Bean 11089* (BRI); S.F. 898, *c.* 6 km N of Watalgan, 24°36′S, 152°01′E, Aug

1996, *Bean 10532* (BRI); Littabella N.P., *c.* 40 km NW of Bundaberg, 24°38′S, 152°03′E, Nov 1993, *Bean 7014* (BRI). Wide Bay District: Great Sandy N.P., Fraser Island, Platypus Bay access track, 5.5 km WNW of Orchid Beach, 24°56′S, 153°15′E, Sep 2004, *Forster PIF30255 & Leiper* (BRI, HO); Kinkuna [now Burrum Coast] N.P. near Bundaberg, 25°03′S, 152°24′E, Jul 1996, *Leiper s.n.* (BRI [AQ653466]); 16 km from Old Bruce highway, towards Burrum Heads, 25°12′S, 152°36′E, Aug 1994, *Bean 7810* (BRI, MEL); Craignish, 25°17′S, 152°42′E, Aug 1996, *Forster PIF19517 et al.* (BRI, MEL); Between Lakes Benaroon & Boeminger, Fraser Island [Great Sandy N.P.], 25°32′S, 153°03′E, Sep 1986, *Russell-Smith 1787 & Lucas* (BRI); Poona N.P., 25°35′S, 152°50′E, Aug 1996, *Forster PIF19559 et al.* (BRI); Quarry off Freshwater road, Rainbow Beach road end, Cooloola, 25°56′S, 153°04′E, Sep 1994, *Grimshaw G946 & Turpin* (BRI, CANB); Mt Bilewilum [Great Sandy N.P.], 26°00′S, 153°02′E, Aug 1994, *Forster PIF15682* (BRI, K, MEL, NSW); Harry Springs Hut road, Cooloola [N.P.], 26°12′S, 152°59′E, Aug 1994, *Grimshaw G892 & Turpin* (BRI); Just E of S.F. 959, SW of Noosaville, 26°24′S, 153°01′E, Aug 1994, *Bean 7789* (BRI); Noosa N.P., 26°24′S, 153°06′E, Sep 1985, *Sharpe 3940 & Batianoff* (BRI). Moreton District: North Stradbroke Island, between Myora Swamp and main east coast road, 27°27′S, 153°26′E, Sep 1993, *Sparshott 135 & Holland* (BRI); Plunkett S.F. 766, Sep 1992, *Leiper s.n.* (BRI [AQ547466]).

***Notes*:** Armstrong (2002) indicated that the stamens of *Zieria laxiflora* are glabrous and that the sepals were almost equal to the petals. Both Armstrong (2002) and Armstrong & Harden (2002) use these features to separate this species from *Z. laevigata* (with hirsute stamens and sepals shorter than the petals) in their keys to species. This is confusing as both treatments indicate in the descriptions that the sepals (*c.* 1.7 mm) of *Z. laxiflora* are half the length of the petals (*c.* 3.4 mm): hardly 'equal to'. The description is amended above. During this study it was noted that some plants of *Z. laxiflora* from coastal areas to the north of the range of the species had stamens with hirsute filaments (see above and the key to species).

***Distribution and habitat*:** This species is widespread in coastal areas from central NSW, north to Shoalwater Bay in Qld within the Southeast Queensland bioregion (**Map 7**). *Zieria laxiflora* is an inhabitant of coastal wallum heathland on stabilised sand-dunes.

***Phenology*:** Flowers have been collected from May to August, and fruit from July to October.

***Conservation status*:** It is a common species in Qld, although many populations have been destroyed because of coastal development for agriculture, forestry, industry or housing. Populations are present in National Parks at Burrum Coast (Kinkuna), Cooloola, Deepwater, Fraser Island, Littabella, Noosa Heads, Shoalwater Bay and Stradbroke Island. An appropriate conservation status is **Least Concern** (IUCN 2001).

23. Zieria madida Duretto & P.I.Forst., **species nova** a *Z. montana* J.A.Armstr. floribus paucioribus in quaque inflorescentia (3–10 adversum 10–20+) et a *Z. alata* Duretto & P.I.Forst. foliolis obtusis (in illa acutis) differt. **Typus:** Queensland. Cook District: Thornton Peak, in valley between north and south peaks near campsite on Hilda Creek, 16°10′S, 145°22′E, 25 September 1984, *J.R.Clarkson 5587* (holo: BRI; iso: CANB, HO, K, L, NSW, QRS *distribuendi*)

Zieria sp. (Thornton Peak J.R.Clarkson 5556); Forster (1997b: 188; 2002: 181).

Zieria sp. (Pieter Botte M.Godwin C2471); Forster (1997b: 188; 2002: 181).

Shrub to 2 m tall, forming an open compact bush. Stems erect to somewhat decumbent, wiry; branches with prominently, raised decurrent leaf bases, not or slightly glandular verrucose, glabrous or simple and/or stellate glabrescent; older branches not or slightly lenticellate and corky, conspicuously scarred from the fallen buds and leaves. Leaves palmately trifoliolate; petioles 8–23 mm long, very slightly verrucose, glabrous or stellate glabrescent; terminal leaflets elliptic to obovate, 15–29 × 5–14 mm, laminae not glandular verrucose, glabrous, tips obtuse or rarely slightly acute (*Godwin 2471*), margins entire and flat; lateral leaflets similar to terminal leaflets and can be shorter or longer. Inflorescence axillary, shorter than the subtending leaf, 3–10-flowered with only 1–3 open at any one time; peduncle 4–13 mm long, with prominent ridges, not glandular verrucose, glabrous or glabrescent; bracts scale like, persistent, slightly glandular verrucose, stellate glabrescent; pedicels 1.5–2.2 mm long, prominently ridged, glandular verrucose, stellate tomentose. Sepals broadly deltate, *c.* 0.7 × 1.2 mm, imbricate in bud, not or slightly glandular verrucose, tips acute, adaxial surfaces glabrous, abaxial surfaces sparsely stellate pubescent at the base. Petals elliptic, 3.5–3.7 × *c.* 2 mm, white to pale pink, dotted with pellucid glands abaxially, stellate pubescent on both surfaces. Staminal filaments 1.5–1.7 mm long, sparsely (*Godwin 2471*) to densely stellate pubescent, particularly towards the apex, not or very slightly glandular distally; anthers 0.8–1 mm long, apiculum absent. Ovary glabrous; style with scattered stellate hairs. Cocci *c.* 4 × 2.5 mm, smooth, glabrous. Seeds not observed. **Fig. 13.**

***Additional selected specimens examined*: Queensland.** Cook District: Timbercamp Creek on road between Daintree and Bloomfield Rivers, 16°01′S, 145°20′E, Aug 1972, *Webb & Tracey 12158* (BRI); Mt Pieter Botte, 16°05′S, 145°24′E, Jul 1983, *Godwin C2471* (BRI); Thornton Peak [Daintree N.P.], on plateau of summit between the campsite on Hilda Creek and the summit, 16°09′S, 145°22′E, Sep 1984, *Clarkson 5556* (BRI, CANB, HO, K); Hilda Creek, Thornton Peak, 16°10′S, 145°21′E, Sep 1992, *Le Cussan 148* (QRS); Thornton Peak, 16°10′S, 145°23′E, July 1979, *Hind 2429, 2431, 2434, 2438* (NSW); *loc. cit.*, 16°10′S, 145°23′E, Nov 1973, *Stocker 1099* (CANB, NSW); *loc. cit.*, Mar 1932, *Brass 2281* (BRI); *loc. cit.*, Sep 1937, *Brass & White 207* (BRI); *loc. cit.*, May 1967, *Olsen 413* (BRI); *loc. cit.*, Jun 1967, *Olsen 413* (NSW).

***Notes*:** Specimens of this species were included in the broadly circumscribed *Zieria montana* by Armstrong (2002). *Zieria madida* differs most noticeably from *Z. montana* by the leaflets that are entire (versus crenulate), fewer flowers per inflorescence (3–10, versus 10–20+) and pedicels that are prominently ridged and glandular verrucose (versus slightly ridged and not glandular verrucose). Differences between *Z. madida* and *Z. alata* are outlined under the account of the latter species.

There is some noteworthy variation in *Z. madida* that requires field research: *Webb & Tracey 12158* is more glandular verrucose than other specimens and apparently from a fairly low altitude; and the leaflets of *Godwin 2471* are more acute than those of other collections.

***Distribution and habitat*:** The species is endemic to north-eastern Qld where it has been found on and around Thornton Peak and Mt Pieter Botte within the Wet Tropics bioregion (**Map 6**). It has been collected from a variety of communities including clefts and crevices in *Borya* patches, low closed forest and heath, all usually in exposed, windswept situations on granite over 900 m. *Webb & Tracey 12158* was collected at around 200 m at the edge of a rock outcrop in complex mesophyll vineforest on riverine levee.

***Phenology*:** Flowers have been collected in June, September and November, and fruit in September.

***Conservation status*:** *Zieria madida* can be common where found and there are no immediate threats; however, the known area of occupancy is small and there are no additional areas of potential habitat in the vicinity. Surveys are required to determine the number of populations, number of individuals and the area of occupancy. The species is present in Daintree N.P. at Thornton Peak. A conservation status of **Near Threatened** based on criterion D (IUCN 2001) is recommended.

***Etymology*:** The specific epithet is derived from the Latin adjective *madidus* (moist) and refers to the wet and misty habitat on the summits of Thornton Peak and Mt Pieter Botte.

24. Zieria minutiflora Domin, *Biblioth. Bot.* 89: 283 (1926). Based on *Boronia minutiflora* F.Muell., *Fragm.* 1: 100 (1858), *nom. illeg.* (see Armstrong 2002). **Type:** Queensland. Moreton District: Glasshouse Mountains, Moreton Bay, 1857, *F.Mueller s.n.* (lecto [designated by Armstrong (2002: 393)]: MEL 62124; isolecto: K [Herbarium Hookerianum; 2 sheets]).

Zieria minutiflora and *Z. obovata* appear to be closely related (see notes under the latter species). Armstrong (2002) considered that this species comprised two subspecies, both of which occur in Qld.

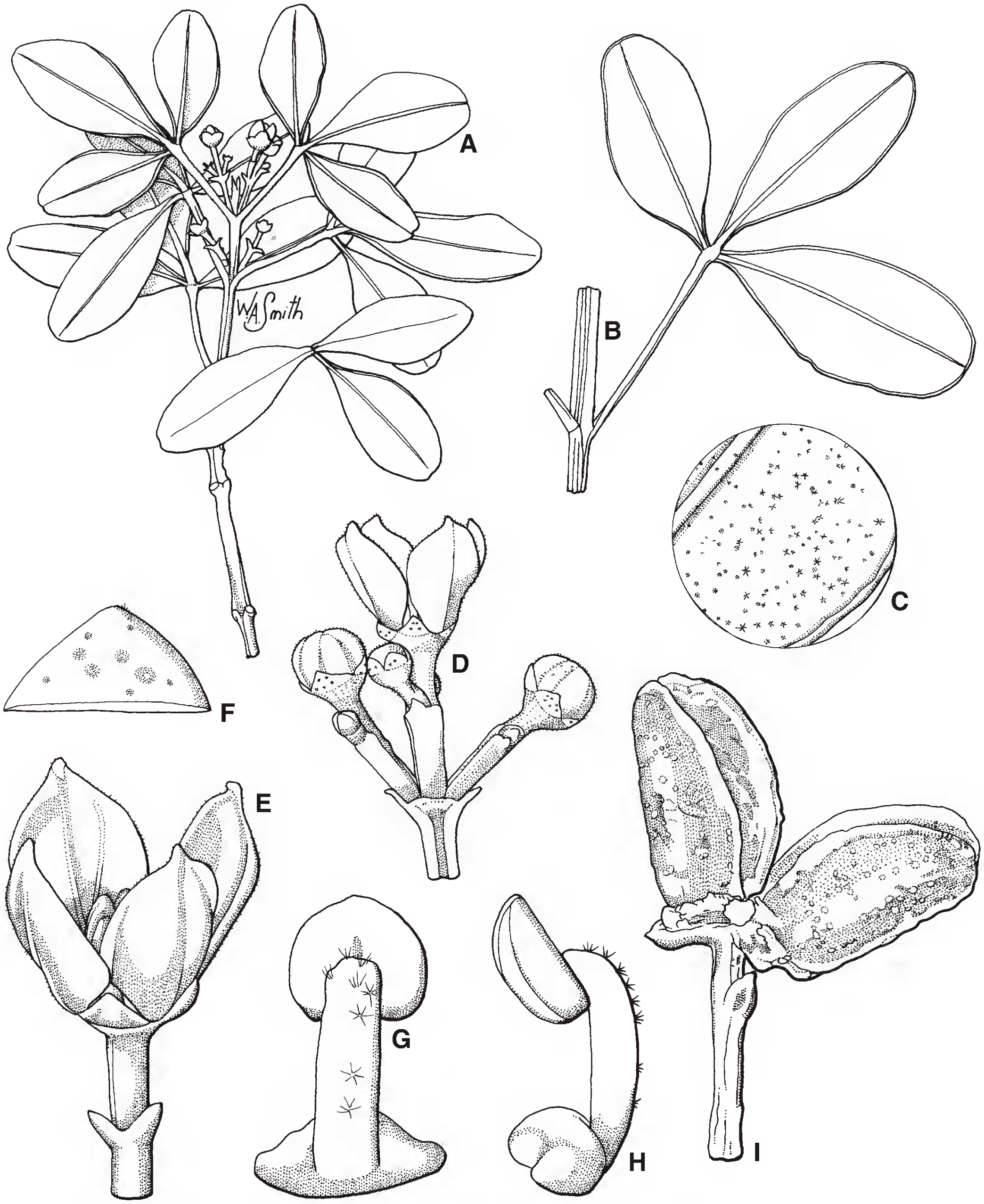


Fig. 13. ***Zieria madida.*** A. branch with several flowering inflorescences × 1.5. B. stem node with abaxial view of leaf × 1.5. C. detail of indumentum on abaxial surface of leaflet × 8. D. inflorescence with buds and flower × 4. E. flower × 8. F. tip of abaxial side of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. A, C & I from *Brass 207* (BRI); B, D–H from *Clarkson 5587* (BRI). Del. W. Smith.

Key to the subspecies of *Z. minutiflora*

1. Ovary and fruit glabrous; pedicels and peduncles glabrous or glabrescent . . . . subsp. **minutiflora**
   Ovary and fruit hirsute; pedicels and peduncles hirsute, rarely glabrescent . . . . subsp. **trichocarpa**

24a. Zieria minutiflora subsp. **minutiflora**

Illustrations: Williams (1987: 319) [as *Z. minutiflora*]; Armstrong (2002: 394, 395); Haslam (2004: 114); Logan River Branch SGAP (QLD Region) Inc. (2005: 176).

Additional selected specimens examined: **Queensland.** Wide Bay District: 1 km W of Butler's Knob, 16 km N of Gympie, 26°03′S, 152°41′E, Oct 1993, *Bean 6692* (BRI); Tewantin S.F. 969, between Tewantin and Cooroy, 26°23′S, 153°00′E, Feb 1994, *Grimshaw G482* (BRI); Conondale Range, S.F. 274 Conondale, *c.* 1.5 km E of Funnels Hut road turnoff on Jimna – Kenilworth road, 26°40′S, 152°37′E, Oct 1982, *McDonald 3657 & Williams* (BRI). Moreton District: York Creek, 6 km NW of Yandina, 26°32′S, 152°54′E, Apr 1993, *Bean 5947* (BRI); S.F. 783, 4 km NW of Montville, 26°39′S, 152°51′E, May 2001, *Forster PIF27106 et al.* (BRI, MEL, NSW); Adjacent to corner of Sunshine Motorway & Mooloolabah road, Buderim, 26°40′S, 153°05′E, Sep 2002, *Forster PIF28821* (A, BRI, CANB, L, MEL, MO, NSW, NY); Summit of Mt Ngungun, Glasshouse Mtns [N.P.], 26°54′S, 152°55′E, May 1993, *Powell 4611* (BRI, NSW *n.v.*); 1 km NNE of Mt Tibrogargan, N of Beerburrum, 26°55′S, 152°57′E, Feb 1997, *Bean 11660* (BRI); Diana's Bath area, D'Aguilar Range, 9 km E of Somerset Dam, 27°06′S, 152°38′E, Jun 1993, *Forster PIF13347 et al.* (BRI); S.F. 893, Mt Mee, 27°06′S, 152°42′E, Aug 1995, *Forster PIF17376* (BRI, MEL).

Distribution and habitat: This subspecies is widespread from near Coffs Harbour in NSW through south-eastern Qld with a northern limit just north of Gympie within the Southeast Queensland bioregion (**Map 6**). It is found as an understorey bush in woodland dominated by eucalypts such as *Corymbia citriodora*, *Eucalyptus acmenoides, E. dura, E. microcorys, E. pilularis, E. racemosa* and *Syncarpia glomulifera* usually on metamorphic substrates, volcanics or on trachyte in the Glasshouse Mountains (not granite as stated by Armstrong 2002).

Phenology: Flowers and fruit have been collected throughout the year.

Conservation status: This subspecies is widespread and common and is present in various National Parks including Conondales, Coolum, Glasshouse Mountains, Noosa and Mooloolah River. An appropriate conservation status is **Least Concern** (IUCN 2001).

24b. Zieria minutiflora subsp. **trichocarpa** J.A.Armstr., *Austral. Syst. Bot.* 15: 396 (2002). **Type:** Queensland. North Kennedy District: 3.8 km S of Ravenshoe Post Office, on the Tully Falls road, 17°39′S, 145°31′E, 7 September 1977, *J.A.Armstrong 1022 & D.F.Blaxell* (holo: NSW 458956; iso [as per Armstrong (2002)]: BRI, MEL *n.v.* [specimen could not be located], CANB [CANB 333073, CBG 8208513], PERTH *n.v.*).

Zieria sp. 12 (sp. "L"; Russell River, S.Johnson s.n., 1892 [189]); Briggs and Leigh (1996: 170, 290).

Zieria sp. (Russell River S.Johnson in 1892); Forster (1997b: 188).

Zieria minutiflora subsp. (Danbulla L.J.Webb 5732); Forster (2002: 181).

Illustrations: Pearson & Pearson (1992: 213) [as *Z. minutiflora*]; Armstrong (2002: 397).

Additional selected specimens examined: **Queensland.** Cook District: Danbulla, Feb 1962, *Webb 5732 & Tracey* (BRI); S.F.R. 185, Platypus L.A., 17°10′S, 145°30′E, Feb 1972, *Stevens 375 & Dockrill* (BRI, QRS); SW of extension of Gadaloff road, Gadgarra S.F., 17°19′S, 145°42′E, Apr 1995, *Horton SH114A* (BRI); Hillcrest on Old Mailmans track [Wooroonooran N.P.], 17°20′S, 145°43′E, Feb 1995, *Hunter JH232* (BRI); road to Windin Falls from S side of basin, 17°20′S, 145°44′E, Mar 1995, *Hunter JH2586* (BRI); S.F.R. 194, Atherton, Nov 1973, *Hartley 14153* (BRI, CANB *n.v.*); Stuart Head, 4.5 km E of Herberton, 17°23′S, 145°26′E, Jan 1998, *Wannan BSW535* (BRI); Towalla lookout, 17°27′S, 145°46′E, May 1995, *Jago 3436* (BRI); S.F. 488, near Ravenshoe, 17°38′S, 145°29′E, Mar 2004, *McDonald KRM1910* (BRI). North Kennedy District: Rapid Creek, Princess Hills section of Lumholtz N.P., 18°23′S, 145°36′E, May 1994, *Cumming 13023* (BRI); 32 km S of Cardwell, Bishops Peak, eastern spur, 18°28′S, 146°08′E, Nov 1991, *Halford Q711* (BRI); Bishop Peak, Hinchinbrook Channel N.P., N of Ingham, 18°29′S, 146°08′E, May 1991, *Bean 3254* (BRI). South Kennedy District: Dicks Tableland, Eungella N.P., 20°59′S, 148°31′E, Sep 1991, *Bean 3666* (BRI). Port Curtis District: Shoalwater

Bay, Mt Parnassus sector, 22°51′S, 150°34′E, Jun 1999, *Brushe JB1933 & Power* (BRI); near Mt Atherton, Dec 1992, *Melzer RM72* (BRI); Upper Stony Creek area in Bowenia S.F., *c.* 30 km NNW of Yeppoon, May 1982, *Anderson 3034* (BRI); Byfield, Keppel Bay, Sep 1931, *White 8040* (BRI). LEICHHARDT DISTRICT: Blackdown Tableland [N.P.], *c.* 35 km SE of Blackwater, campsite at old stockyard on Mimosa Creek, Sep 1971, *Henderson H1164 et al.* (BRI).

***Distribution and habitat*:** This subspecies is endemic to Qld within the Brigalow Belt, Central Queensland Coast, Einasleigh Uplands and Wet Tropics bioregions and is widespread with a northern limit at Danbulla on the Atherton Tablelands and a southern, somewhat disjunct limit at Blackdown Tableland (**Map 6**). Recent collections have partially filled in the distributional gap north of Byfield as mapped by Armstrong (2002). The subspecies occurs in woodland dominated by eucalypts on a wide range of substrates including sandstone and granite.

***Phenology*:** Flowers have been collected from January to November and fruit from February to October.

***Conservation status*:** *Zieria minutiflora* subsp. *trichocarpa* is common and widespread with populations in National Parks such as Blackdown Tableland, Eungella, Hinchinbrook Channel, Lumholtz and Wooroonooran. An appropriate conservation status is **Least Concern** (IUCN 2001).

25. Zieria montana J.A.Armstr., *Austral. Syst. Bot.* 15: 398 (2002). **Type:** Queensland. MORETON DISTRICT: Mt Barney, in saddle between east and west peaks, 26 September 1977, *J.A.Armstrong 1142 & J.Powell* (holo: NSW 368627; iso [as per Armstrong (2002)]: AD *n.v.*, BRI, CANB 559205, K *n.v.*, MEL *n.v.* [specimen could not be located], PERTH *n.v.*).

***Illustrations*:** Armstrong (2002: 399, Fig. 86A,B,D,E).

Shrub to 2.5 metres tall, forming an open compact bush. Stems erect, wiry; branches very prominently ridged, conspicuously scarred from the fallen buds and leaves, slightly glandular verrucose when young, glabrous to glabrescent; older branches lenticellate and corky. Leaves palmately trifoliolate; petioles 10–20 mm long, slightly glandular verrucose, glabrous or glabrescent; terminal leaflets elliptic to obovate, 20–45 × (5–) 10–17 mm, laminae not glandular verrucose, tips obtuse, margins flat, thickened, crenulate (particularly towards the tip), midveins raised abaxially, secondary venation obscure, adaxial surfaces glabrous except for scattered hairs along midvein, abaxial surfaces glabrous; lateral leaflets similar to terminal leaflets, smaller or longer. Inflorescence axillary, shorter than the subtending leaf, 10–20⁺-flowered, all or most of flowers opening at once, not or slightly glandular verrucose, sparse indumentum of stellate hairs; peduncle 5–17 mm long, ridged; bracts scale or leaf like, deciduous, to 5 mm long, slightly verrucose, stellate pubescent on both surfaces; pedicels slightly ridged, 1.5–4 mm long, not glandular verrucose, stellate tomentose. Sepals broadly to transversely ovate, 0.7–1 × *c.* 1 mm, valvate or slightly imbricate in bud, very slightly glandular verrucose, tips obtuse, adaxial surfaces glabrescent, abaxial surfaces stellate glabrescent to pubescent at the base. Petals elliptic to broad elliptic, 4–4.5 × *c.* 2 mm, white, fringed with pink, imbricate in bud, dotted with pellucid glands, stellate pubescent on both surfaces. Staminal filaments *c.* 1.8 mm long, glabrous or hirsute with stellate hairs particularly towards the apex, not or slightly glandular verrucose distally; anthers *c.* 0.8 mm long, apiculum absent. Gynoecium glabrous. Cocci [mature not observed] slightly glandular verrucose, glabrous, base of style persistent forming a minute apical apiculum. Mature seeds not observed.

***Additional selected specimens examined*: Queensland.** MORETON DISTRICT: Mt Barney [N.P.], south slopes, 28°17′S, 152°41′E, Oct 1992, *Forster PIF11879 et al.* (BRI, MEL); Mt Barney, Rum Jungle, 28°17′S, 152°41′E, Sep 1994, *Forster PIF15724* (BRI, HO, MEL); Vicinity of hut, Mt Barney, Dec 1974, *McDonald 759* (BRI); Mt Barney, 28°17′S, 152°42′E, Jun 1972, *Bell 535* (BRI).

***Notes*:** Armstong (2002) included specimens from Mt Barney (south-east Qld) to the Thornton Peak area (north-east Qld) in his concept of *Zieria montana.* He noted that specimens from Mt William (Eungella N.P., central Qld) had smaller leaves than plants from other areas. The material from Mt William is recognised here as a distinct species, *Z. eungaellensis* (see above). Other populations from Qld are here described as *Z. alata* (Mt Lewis area, Cook District), *Z. madida* (Thornton Peak area, Cook District), *Z. boolbunda* (Mt Perry area, Burnett District) and *Z. scopulus* (Mt Elliot and Flinders Peak, Moreton District). The collection from Hinchinbrook Island (*Fell DF1230*) cited by Armstrong (2002) under *Z. montana* is actually a specimen of *Z. robertsiorum* (see below).

Material illustrated as *Zieria montana* (Logan River Branch (SGAP Qld Region Inc.) 2005) and that originated from the Lions road to the Pinnacle in northern NSW (G.Leiper *pers. comm.* Jan 2006) is not supported by vouchers and its taxonomic status is uncertain.

***Distribution and habitat*:** *Zieria montana* is endemic to Qld and is restricted to Mt Barney within the Southeast Queensland bioregion (**Map 4**). It is found in clefts and crevices on rocky, granophyre (Willmott 2004) outcrops in low heath or microphyll moss/fern thicket.

***Phenology*:** Flowers have been collected from September to December. Fruiting time is unknown.

***Conservation status*:** All known populations of this species are found in Mt Barney N.P. A conservation status of **Vulnerable** based on the criterion D2 (IUCN 2001) is appropriate for this species. Surveys are required to determine the number of populations, number of individuals and an area of occupancy. Perceived threats are too frequent fires in the habitat and localised destruction of plants by bushwalkers.

26. Zieria obovata (C.T.White) J.A.Armstr., *Austral. Syst. Bot.* 15: 408 (2002); *Zieria aspalathoides* A.Cunn. ex Benth. var. *obovatum* C.T.White, *Proc. Roy. Soc. Queensland* 53: 208 (1942). **Type:** Queensland. North Kennedy District: Herberton, January 1912, *F.H.Kenny s.n.* (holo: BRI [AQ337221]).

Zieria sp. (Herberton J.A.Armstrong 1025); Forster (1997b: 188).

***Illustrations*:** Armstrong (2002: 409, 410).

***Correction to description given in Armstrong (2002)*:** Adaxial surfaces of leaflets glabrescent to sparsely pilose.

***Additional selected specimens examined*:** **Queensland.** North Kennedy District: Wild River Gorge, 5 miles [8.3 km] from Herberton, 17°22′S, 145°25′E, Jun 1972, *Wrigley & Telford NQ750* (CANB); Wild River, Herberton, 17°23′S, 145°23′E, Mar 1996, *Jago 3834* (BRI); 2 km W of Herberton, 17°23′S, 145°23′E, Dec 2000, *Freeman 'Rush Track 13'* (BRI); Herberton, Macleod Street trail, 17°23′S, 145°23′E, Feb 2003, *Holmes 211 & Holmes* (BRI); Herberton Weir, Wild River, S branch, 17°23′S, 145°25′E, Feb 1990, *Forster PIF6251* (BRI); Wild River Dam, 17°24′S, 145°24′E, Feb 1989, *Jones 3530* (CANB); Herberton, Atherton road, mountain to west of Caravan Park, Jun 1975, *Sharpe 1458* (BRI).

***Notes*:** *Zieria obovata* is closely related to *Z. minutiflora*. Armstrong (2002: 411) said that the former differs from the latter by 'having non-emarginate lamina that are glabrous on the upper surface'. His description of *Z. obovata* (p. 408) indicated that the adaxial surfaces of the leaves are glabrescent with the hairs confined to the midrib or scattered over the surface. Specimens seen of *Z. obovata* have adaxial leaflet surfaces that are glabrescent to sparsely pilose while those of *Z. minutiflora* are densely pilose. The leaflets of *Z. minutiflora* are not always emarginate. The main distinguishing character that can be used to separate the species is the relative size of the inflorescence: in *Z. obovata* they are longer than the leaves and in *Z. minutiflora* they are usually shorter, at least at anthesis. Field and laboratory research is required to ascertain if the recognition of *Z. obovata* as a species distinct from *Z. minutiflora* is warranted.

***Distribution and habitat*:** *Zieria obovata* is endemic to Qld with a restricted distribution in the area around Herberton within the Wet Tropics bioregion (**Map 4**). The species occurs in wet open eucalypt forest in rocky areas based on granite substrates. Specimens purportedly collected from Trinity Bay in 1882 (*Fitzgerald s.n.* [MEL622969 & 62274]); listed by Armstrong (2002) under *Infraspecific variation* and *Specimens Examined* only) are assumed to have erroneous locality information.

***Phenology*:** Flowers and fruits have been collected from September to March and in June.

Conservation status**:** *Zieria obovata* should be allocated a similar conservation status to co-occurring near endemics such as *Parsonsia wildensis* J.B.Williams (Rare with a 2006 reassessment recommending that this be changed to Vulnerable) or *Tylophora rupicola* P.I.Forst. (Endangered). An appropriate conservation status is **Vulnerable** based on the criterion D2 (IUCN 2001). Surveys are required to determine the number of populations, number of individuals and the area of occupancy.

27. Zieria rimulosa C.T.White, *Proc. Roy. Soc. Queensland* 53: 210 (1942). **Type:** Queensland. Cook District: Mt Mulligan, 21 April 1931, *McDonald 450* (holo: BRI [AQ520879], iso: QRS).

Illustrations**:** Armstrong (2002: 428, 429).

Additional specimens examined**:** Cook District: Reedy Creek, Carbine Tableland, 16°24′S, 145°11′E, Aug 2003, *Burnett KRM1919* (BRI); Mt Mulligan, *c.* 40 km NW of Dimbulah, 16°54′S, 144°51′E, Sep 1986, *Clarkson 6587* (BRI, CANB); *loc. cit.*, Apr 1985, *Clarkson 5926* (BRI, CANB, MEL); *loc. cit.*, Apr 1985, *Clarkson 5802* (BRI, MEL).

Distribution and habitat**:** This species is endemic to north Qld and known from Mt Mulligan and the Carbine Tableland within the Einasleigh Uplands bioregion (**Map 4**). Plants occur on sandstone pavement or clifflines.

Phenology**:** Flowers and fruits have been collected in April.

Conservation status**:** This species is listed as **Vulnerable** in Qld (*NCR* 2006).

28. Zieria robertsiorum J.A.Armstr., *Austral. Syst. Bot.* 15: 429 (2002). **Type:** Queensland. Cook District: Mt Finnigan, 7 September 1948, *L.J.Brass 20113* (holo: BRI; iso [as per Armstrong (2002)]: CANB *n.v.*).

Illustrations**:** Armstrong (2002: 431, 432).

Shrub to 2 m tall, forming an open compact bush. Stems erect to decumbent, wiry; branches with slight to prominently decurrent leaf bases, not glandular verrucose, with a moderately dense indumentum of mainly stellate hairs evenly spread around branches, becoming glabrous with age. Leaves palmately trifoliolate, not or very rarely slightly glandular verrucose; petioles 2.5–10 mm long, glabrescent or having a sparse to moderately dense stellate indumentum; terminal leaflets elliptic to obovate, 6–23 (–28) × 2.5–11 mm, tips obtuse or slightly acute (Hinchinbrook Is.), margins entire, flat or slightly recurved (sometimes revolute on drying), midribs on abaxial surfaces raised, secondary veins obscure, adaxial surfaces with few hairs along midribs or with a sparse to moderately dense stellate indumentum, abaxial surfaces with a sparse to moderately dense stellate indumentum, sometimes only on midribs (Malbon Thompson & Lamb Ranges); lateral leaflets similar to terminal leaflets though usually shorter. Inflorescence axillary, shorter than or nearly equal to subtending leaf, usually 3–10-flowered though only 1–3 flowers open at any time, not glandular verrucose, with a sparse to moderately dense stellate indumentum; peduncle 1.5–12 mm long; bracts scale to leaf like, persistent, to 3 mm long; pedicels 2.5–4.5 mm long. Sepals almost semi-circular to broadly deltate, 0.7–1 × 1–1.2 mm, slightly imbricate in bud, not or slightly glandular verrucose, tips obtuse to acute, adaxial surfaces with scattered appressed simple and stellate hairs, abaxial surfaces with a dense stellate indumentum though this sometimes confined to the base. Petals elliptic, 1.5–3.5 × 1.2–1.5 mm, white, dotted with pellucid glands; adaxial surfaces with a dense stellate indumentum, abaxial surfaces with a moderately dense stellate indumentum, denser along margins. Staminal filaments *c.* 1.5 mm long, glabrous or glabrescent or with scattered stellate hairs, slightly glandular or not at tip; anthers *c.* 0.6 mm long, apiculum absent. Ovary glabrous or with a sparse stellate indumentum; style glabrous. Cocci *c.* 3 × 2 mm, smooth, glabrous, base of style persistent forming a minute apical apiculum. Seeds oblong-ovoid, 2–2.5 × 1.2–1.5 mm, black, dull, longitudinally striate.

Additional specimens examined**: Queensland.** Cook District: Mt Finnigan, S of Cooktown, Dec 1991, *McDonald s.n.* (BRI [AQ520392]); Cedar Bay N.P., Mt Finnigan summit area above Horans Creek, 15°49′S, 145°16′E, Oct 1999, *Forster PIF25031 & Booth* (BRI); Mt Finnigan, on summit, 15°49′S, 145°18′E, Sep 1992, *Armstrong 1032* (CANB, NSW); S.F.607, Kahlpahlim Rock, Lamb Range, 17°01′S, 145°37′E, May 2000, *Forster PIF25766 et al.* (BRI, HO, MEL, NSW); *loc. cit.*, Apr 2005, *Forster PIF30637 et al.* (BRI, HO); Hilltop

0.5 km SE of Kahlpahlim Rock with telecommunications, Jul 2000, *Wannan 1845* (CANB); Kahlpahlim Rock, Jul 2000, *Wannan 1844* (BRI); Lamb Range, near summit Lamb's Head, 17°01′S, 145°38′E, Mar 1992, *Le Cussan 81* (QRS); Lamb's Head, Lamb Range, 17°02′S, 145°38′E, *s.dat.*, *Godwin s.n.* (BRI [AQ408269]); Bell Peak, *c.* 15 km E of Gordonvale, 17°05′S, 145°52′E, Jul 1995, *Jago 3531* (BRI); North Bell Peak, summit area, Malbon Thompson Range, 17°05′S, 145°52′E, Nov 1995, *Forster PIF18047 et al.* (BRI, MEL); Bell Peak, 17°07′S, 145°52′E, 1996, *Godwin C4293 et al.* (BRI). NORTH KENNEDY DISTRICT: Hinchinbrook Island, Mt Bowen summit, [Hinchinbrook Channel N.P.] 18°21′S, 146°15′E, Jul 1988, *Fell DF1230* (CANB); Hinchinbrook Island, ridge 1 km N of Mt Bowen, Aug 1975, *Hockings s.n.* (BRI [AQ229910]); *c.* 2 km NW of Mt Diamantina [Hinchinbrook Channel N.P.], 18°25′S, 146°17′E, Dec 2000, *Kemp TH2504* (BRI).

***Notes*:** Armstrong (2002) indicated that the sepals or calyx lobes of *Zieria robertsiorum* are almost semi-circular with an obtuse to rounded apex. Though most of the material from the type locality (the summit of Mt Finnigan) do have sepals of this nature, others (e.g. *McDonald s.n.* (BRI [AQ520392])) have sepals with an acute apex. The density of the indumentum on the abaxial surfaces of the sepals also varies at Mt Finnigan: the indumentum may be dense and evenly spread over the entire surface or more or less confined to the base of the sepal. Specimens from further south have sepals with acute tips and with the indumentum more or less confined to the base on the abaxial surfaces. Sepals of this nature are similar to those of *Z. smithii* subsp. *tomentosa sensu* Armstrong (2002). *Z. smithii* subsp. *tomentosa* has leaflets with acute tips (versus usually obtuse in *Z. robertsiorum*) and branches without obvious decurrent leaf bases (versus obvious). The specimens collected from Hinchinbrook Island have a sparse to moderately dense stellate indumentum on the adaxial surfaces of the leaves (versus glabrescent) and ovary (versus normally glabrous).

Armstrong (2002) indicated that the branches of *Zieria robertsiorum* were prominently ridged. Though the branches do have decurrent leaf bases that can be prominent they are not always so and thus may prove problematic when using his key.

Further field and laboratory research is required to determine if the morphological differences between the disjunct populations of *Zieria robertsiorum* warrants taxonomic recognition. This research should include surveys of intervening areas of similar habitat. Any detailed study of variation in *Z. smithii* (see discussion under that species) should also include *Z. boolbunda* and *Z. robertsiorum*.

A specimen of *Zieria eungellaensis* from Mt David (*Bean 4435*) in the Mackay area, is superficially similar to *Z. robertsiorum* but differs in having leaflets with acute (versus obtuse) tips and a sparse indumentum of simple and bifid hairs (versus a sparse to moderately dense stellate indumentum) on the abaxial surface. See further discussion under *Z. eungellaensis*.

***Distribution and habitat*:** *Zieria robertsiorum* is endemic to north-eastern Qld where it is restricted to the Wet Tropics bioregion (**Map 11**). Armstrong (2002) stated that this species was restricted to the "summit of Mt Finnegan [sic]"; however various collections, mostly since the 1980s, have revealed that it is found also to the south on the Malbon Thompson and Lamb Ranges, and on Mt Bowen and Mt Diamantina on Hinchinbrook Island. In all cases it has been collected in clefts and crevices in windswept shrubland in granite boulderfields or pavements at or above 1000 m, often in saxicolous mats composed of sedges and other monocotyledonous plants. This community type is usually clearly delimited from the surrounding vegetation of upland rainforest.

***Phenology*:** Flowers have been collected from May to December, and fruit from July to December.

***Conservation status*:** This species may be locally common and is present in Cedar Bay and Hinchinbrook Channel National Parks and a number of Forest Reserves and State Forests. There are no perceived current threats. An appropriate conservation status is **Least Concern** (IUCN 2001).

29. Zieria scopulus Duretto & P.I.Forst., **species nova** a *Z. montana* J.A.Armstrong foliolis minoribus (11–25 × 2–9 mm adversum 20–45 × (5–) 10–17 mm), foliis basi infirme decurrentibus (non manifeste decurrentibus) et floribus in inflorescentiis omnibus in sequentia maturantibus (non coaetaneis); et a *Z. actites* Duretto & P.I.Forst. caulibus glandulari-verrucosis (non glabris) differt. **Typus:** Queensland. Moreton District: Mt Elliot, 30 km S of Ipswich, 31 May 1990, *L.H.Bird s.n.* (holo: BRI [AQ472279]; iso: CANB).

Zieria sp. (Flinders Peak S.L.Everist 1169); Forster (2007: 183).

Shrub to at least 1 m, forming an open compact bush. Stems erect, wiry; branches with decurrent leaf bases, sometimes faintly so, weakly glandular verrucose with occasional prominent gland, glabrous. Leaves palmately trifoliolate; petioles 5–11 mm long, very slightly glandular verrucose, glabrous or glabrescent; terminal leaflets elliptic or slightly ovate, 11–23 × 3–9 mm, laminae not glandular verrucose, tips acute, margins crenulate, especially in distal half, flat to slightly recurved (sometimes revolute on drying), midribs raised abaxially, secondary veins obscure, glabrous apart from few simple hairs on the proximal portion of the midribs on the adaxial surfaces; lateral leaflets similar to terminal leaflets though may be slightly longer or shorter. Inflorescence axillary, shorter to slightly longer than the subtending leaf, 1–20-flowered though only 1–3 flowers open or in fruit at any one time, not glandular verrucose; peduncle 4–18 mm long, glabrous or glabrescent with stellate hairs; bracts scale like, persistent, to 1 mm long, glabrescent; pedicels 2.5–5 mm long, glabrous or glabrescent with stellate hairs. Sepals deltate, 0.7–1 × 0.7–1 mm, valvate in bud, not glandular verrucose, tips acute, glabrous. Petals elliptic, 2–2.5 × *c.* 1.5 mm, white, valvate in bud, dotted with pellucid glands, adaxial surfaces densely stellate pubescent along margins, pilose centrally, abaxial surfaces densely stellate pubescent along margins, sparsely stellate pubescent centrally. Staminal filaments 1–1.2 mm long, glabrous, slightly glandular towards apex; anthers *c.* 0.6 mm long, apiculum absent. Gynoecium glabrous. Cocci 3–4.5 × 2–2.5 mm, smooth, glabrous, base of style sometimes persistent forming a minute apical apiculum. Seeds oblong-ovoid, *c.* 2.7 × 1.5 mm, black, dull, longitudinally striate. **Fig. 14.**

***Additional specimens examined*:** Moreton District: Flinders Peak, Jun 1935, *Everist 1155 & 1169* (BRI).

***Notes*:** Collections of *Zieria scopulus* were included by Armstrong (2002) in his concept of *Z. montana*; however it differs from that species by the smaller leaves, less pronounced decurrent leaf bases and by having flowers on any one inflorescence that mature in a staggered manner (versus simultaneously). *Z. scopulus* appears to be related to *Z. actites* (described above) though it differs noticeably from that species in having stems that are weakly glandular verrucose (versus smooth).

***Distribution and habitat*:** This species is apparently confined to Flinders Peak and Mt Elliot, near Ipswich, South-East Queensland bioregion (**Map 12**). On Flinders Peak it is found growing in cracks and crevices on trachytic tuff on the top and on the south-western side of the mountain. At Mt Elliot it is found on steep, stony ridges and clifflines of trachyte. The ‘Flinders Group’ of plugs and dykes includes Flinders Peak, Ivory’s Rock, Mts Blaine, Elliot, Goolman and Perry; all are composed of various types of trachyte (Willmott 2004).

***Phenology*:** Flowers and fruit have been collected in May and June.

***Conservation status*:** The collector’s notes indicate that the species was common on the south-western side of Flinders Peak (a council controlled Conservation Park) though not common at the summit. There is no data on the size of the population at Mt Elliot. On the basis of the highly restricted distribution, this species can be assessed as **Vulnerable** on the basis of the D2 criterion (IUCN 2001).

Etymology: The specific epithet is derived from the Latin *scopulus* (rock, cliff or crag) and alludes to the populations of this plant occurring on isolated rocky peaks. This is intended as a noun in apposition.

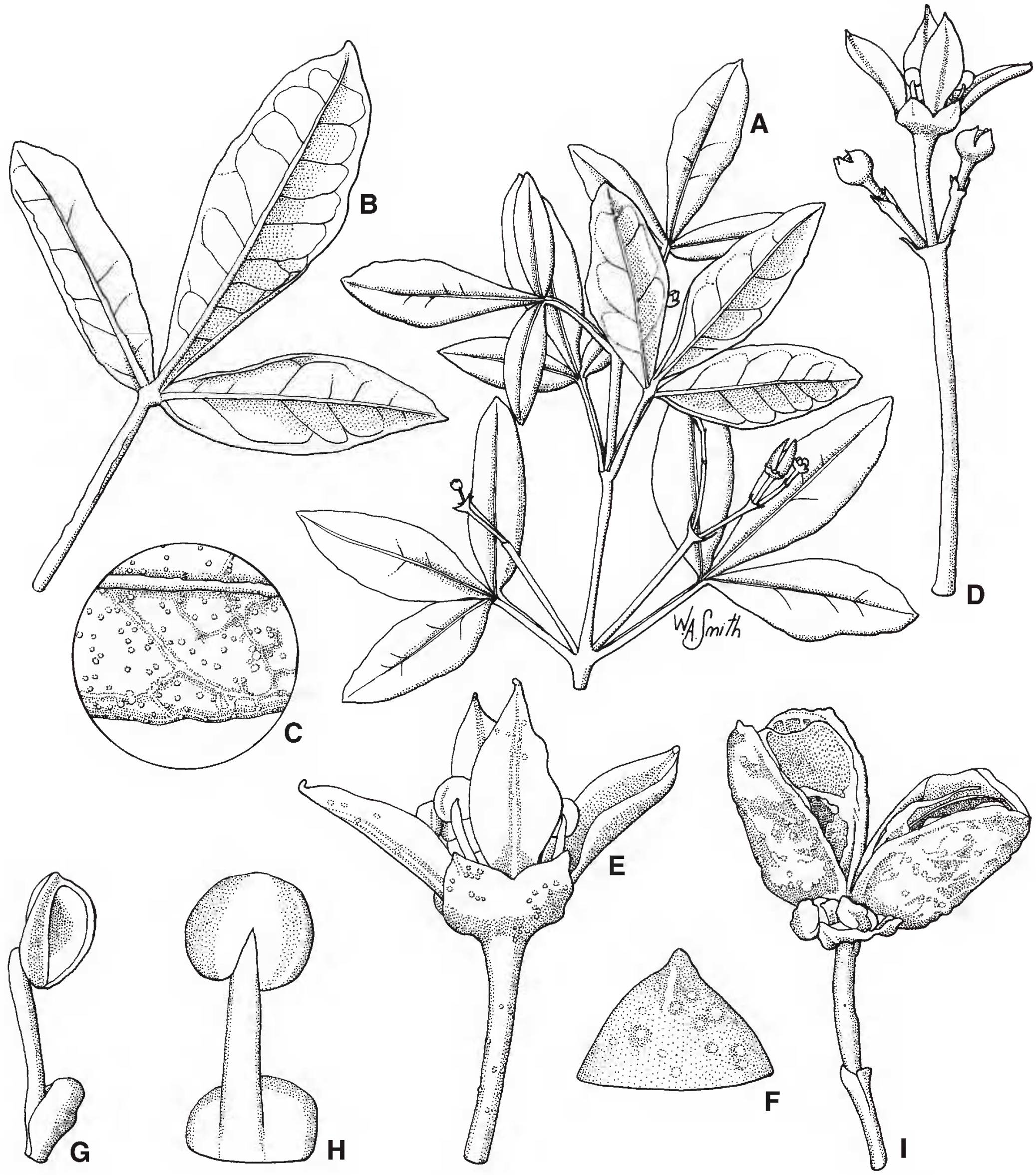


Fig. 14. ***Zieria scopulus.*** A. branch with several budding and fruiting inflorescences × 1.5. B. abaxial view of leaf × 3. C. detail of indumentum on abaxial surface of leaflet × 8. D. inflorescence with flower and buds × 4. E. flower × 8. F. tip of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. A–C, I from *Bird s.n.* (BRI [AQ472289]); D–H from *Everist 1169* (BRI). Del. W. Smith.

30. Zieria smithii Jacks. in Andrews, *Bot. Repos.* 9: t. 606 (1810). **Type:** “Communicated last April by A.B.Lambert, esq., from his collection...” (lecto [icono]: Andrews *ibid, t. 606* [designated by Armstrong (2002: 436)]).

Zieria smithii subsp. *tomentosa* J.A.Armstr., *Austral. Syst. Bot.* 15: 440 (2002), **syn. nov. Type:** Queensland. Cook District: Just above Walsh Falls on the Wallum Trig Road, *c.* 6.5 km N of Atherton, 17°16′S, 145°25′E, 9 September 1977, *J.A.Armstrong 1027 & J.M.Powell* (holo: BRI; iso [as per Armstrong (2002)]: CBG *n.v.*, MEL 2067265, NSW 433230 *n.v.*, PERTH *n.v.*)

Zieria sp. (Mt Ballow, G.Leiper AQ473220); Forster (1997b: 188; 2002: 181; 2007: 183).

***Illustrations*:** Pearson & Pearson (1989: 405); Hauser & Blok (1998: 368); Armstrong (2002: 438, 439, 441, 442); Haslam (2004: 312); Logan River Branch SGAP (QLD Region) Inc. (2002: 328) [as *Z.* sp. Mt Ballow].

***Additional selected specimens examined*: Queensland.** Cook District: Davies Creek, Aug 1999, *Wannan 1393 & Wilson* (BRI, CANB, NSW); S.F. 194, Mt Baldy, Herberton Range, 17°20′S, 145°24′E, Feb 2001, *Forster PIF26731* (A, BRI, HO, L, MEL, NSW, NY). North Kennedy District: Mt Stewart, E of Herberton, 17°23′S, 145°26′E, Jan 1998, *Jago 4650* (BRI, NSW); Near top of Mt Westminster Abbey [Lumholtz N.P.], 18°25′S, 146°02′E, May 1992, *Cumming 12014* (BRI); Frederick Peak, 25 km SW of Townsville, 19°24′S, 146°37′E, May 1991, *Bean 3207* (BRI); Mt Abbot, 50 km W of Bowen, 20°06′S, 147°46′E, Oct 1992, *Bean 5172* (BRI). South Kennedy District: Swampy Ridge, W of Eungella township, 21°05′S, 148°26′E, May 1992, *Bean 4462* (BRI). Leichhardt District: Bat Cave Gorge, Palmgrove N.P., Bigge Range, NW of Taroom, 24°53′S, 149°27′E, Sep 1999, *Forster PIF24711 & Booth* (BRI, MEL); Near Get Down, Robinson Gorge, Expedition N.P., 25°18′S, 149°10′E, Sep 1995, *Forster PIF17729 & Figg* (AD, BRI, MEL, NSW). Maranoa District: Spring Creek Gorge, Carnarvon Ranges, Oct 1933, *White 9492* (BRI). Port Curtis District: Rainbow Falls, Blackdown Tableland [N.P.], 23°51′S, 149°06′E, Jul 1992, *Bean 4661* (BRI, NSW); E escarpment of Kroombit Tops [N.P.], SW of Gladstone, 24°23′S, 151°02′E, *Bean 13130* (BRI); Dawes Range road, S.F. 67 Bulburin, E of Builyan, 24°35′S, 151°30′E, Mar 1995, *Bean 8420* (BRI). Burnett District: Cania Gorge N.P., near ‘Dripping Rock’, 24°43′S, 150°59′E, Nov 1993, *Bean 6961* (BRI); E Boogalgopal L.A., Coominglah S.F., W of Monto, 24°55′S, 150°56′E, Nov 1995, *Bean 9109 & Turpin* (BRI). Wide Bay District: Great Sandy N.P., Fraser Island, near Waddy Point Ranger Station, 24°57′S, 153°20′E, Sep 2004, *Forster PIF30279 & Leiper* (BRI); Mt Benarige, S.F. 57, St Mary, 25°41′S, 152°27′E, Jun 1993, *Forster PIF13391 & Machin* (BRI, CANB). Darling Downs District: Passchendale S.F., Aug 1983, *Harslett s.n.* (BRI [AQ 349640], CANB). Moreton District: Spicers Peak, W peak, Main Range N.P., 28°05′S, 152°23′E, Sep 1995, *Forster PIF17649 et al.* (BRI); Mt Huntley, summit area, Main Range N.P., 28°08′S, 152°25′E, Sep 1994, *Forster PIF15754 & Leiper* (AD, BRI, MEL, NSW); Main Range N.P., N of Mt Steamer, Lophostemon Knoll, 28°11′S, 152°26′E, Sep 1999, *Forster PIF24882 & Leiper* (BRI, MEL, NSW); Miller’s property, Springbrook, 28°11′S, 153°15′E, Jan 2002, *Searle s.n.* (BRI [AQ 732953]); Near Patts Bluff, Lamington N.P., 28°13′S, 153°06′E, Mar 2000, *Bean 16132* (BRI, HO); Mt Gillies, 28°16′S, 152°45′E, Oct 1992, *Forster PIF12114 & Reilly* (BRI, MEL).

***Notes*:** Armstrong (1991a, 1991b, 2002) divided *Zieria smithii* into two subspecies, *viz.* subsp. *smithii* and subsp. *tomentosa*, on the basis of the density of the indumentum on the young branches, petioles and the abaxial surface of the leaflets. Armstrong & Harden (2002) indicated that the distinction between the subspecies is difficult to maintain and so did not describe them in their treatment of *Zieria* for the *Flora of New South Wales*. The distinction between these subspecies in Qld is also difficult to maintain and they are not recognised here despite the northern populations being distinctive in appearance.

In his description of *Zieria smithii*, Armstrong (2002) stated that the branches of the species are ‘tuberculate (strongly so)’ [the term verrucose is used here]. Most specimens seen for Qld have smooth branches unlike many specimens from NSW and Victoria. *Z. smithii* shows considerable variation over its range in the density of the indumentum on various organs, degree of verrucosity of the stems, petioles, leaflets and sepals, size of the leaflets, size and shape of the sepals etc.

Some plants from north-eastern Qld (*Forster PIF26731*) and Eungella N.P. (*Jones 11608*) tend to be slender with relatively small leaves. The density and extent of the stellate indumentum on the abaxial surface of the sepals is also highly variable in these plants: hairs may be confined to the base of the sepals, as with most plants from further south, or spread evenly over the entire surface. *Zieria smithii* subsp. *tomentosa* is based on plants from north-east Qld and the type is similar to these collections.

Plants from the Blackdown Tableland have glabrous stems that are slightly to strongly glandular verrucose. Similar plants are found on Kroombit Tops but sometimes these have stems with a sparse stellate indumentum. The near coastal sandy areas of south-eastern Qld (including the sand islands) have large-leaved plants with smooth stems that have a moderately dense stellate indumentum. Similar plants are found on the Springbrook and Lamington Plateaux but they usually have glabrous stems. Also on the Lamington Plateau and the ‘Scenic Rim’ are plants with slightly glandular verrucose leaves and sepals.

Detailed field and laboratory research is required to determine how many subspecific or additional specific taxa, if any, should be recognized for the populations referred here to *Zieria smithii*. These studies should include *Z. boolbunda* and *Z. robertsiorum*.

***Distribution and habitat*:** *Zieria smithii* is found in Victoria, NSW and Qld. In Qld it is found from the MacPherson Range and the 'Scenic Rim' north to near Atherton. It occurs in the Brigalow Belt, New England Tableland, Southeast Queensland and Wet Tropics bioregions. It occurs in a variety of communities including rainforest, rainforest-sclerophyll ecotones, in open woodland or forest dominated by *Eucalyptus*, *Corymbia*, *Syncarpia* etc., including on occasion, *Agathis*, and in heath and swampy areas. It is also found in rocky areas in rainforests, along creeks, in gorge country and along cliff lines etc. It has been collected on a wide variety of substrates including granite, sandstone, sand and trachyte.

***Phenology*:** Flowers and fruits mainly between January and September though fertile collections have been made in all other months.

***Conservation status*:** The species is common and widespread with many populations in National Parks. An appropriate conservation status is **Least Concern** (IUCN 2001).

31. Zieria southwellii J.A.Armstr., *Austral. Syst. Bot.* 15: 443 (2002). **Type:** New South Wales. North Coast: Dorrigo Plateau, Mt Moombil, 6 km SE of Megan, 30°19′S, 152°52′E, 10 September 1988, *I.R.Telford 10705* (holo: CANB [CBG 8802857]; iso [as per Armstrong (2002)]: BRI, HO *n.v.* [specimen has not been located], NSW *n.v.*, PERTH *n.v.*).

Zieria sp. (Lamington G.Leiper AQ502702); Forster (1997b: 188; 2002: 181).

***Illustrations*:** Armstrong (2002: 444, 445); Logan River Branch SGAP (QLD Region) Inc. (2005: 364).

***Additional specimens examined*:** **Queensland.** Moreton District: Wagawn, Aug 1959, *Blake 20603* (BRI, CANB); 1.2 km along Carrick road, Springbrook, 28°11′S, 153°16′E, Oct 1997, *Bean 12495* (BRI); Boyull Creek, Springbrook, 28°13′S, 153°16′E, Sep 1993, *Forster PIF13881 & Leiper* (BRI, CANB); Wagawn, Lamington N.P., 28°15′S, 153°13′E, Apr 1994, *Forster PIF15120 & Leiper* (BRI, K, MEL, NSW); Near Orchid Grotto, Lamington N.P., 28°14′S, 153°08′E, Aug 1994, *Forster PIF15672 & Leiper* (BRI); *loc. cit.*, Oct 1991, *Ross 3438* (HO, MEL); Coomera Circuit, Lamington N.P., 28°14′S, 153°11′E, Jan 1995, *Forster PIF16063 & Leiper* (BRI, MEL, NSW); Junimbabah Lookout, Lamington N.P., Nov 1990, *Leiper s.n.* (BRI [AQ502702]); Lamington Plateau, Moonlight Crag, near O'Reilly's Guest House, 28°16′S, 153°09′E, May 1994, *Leiper s.n.* (BRI [AQ627912]); Coomera Circuit, N of Coomera Falls, Lamington N.P., Oct 1994, *McDonald 6161* (BRI); Lamington N.P., Beechmont, Jun 1957, *Wilson 697* (BRI). **New South Wales.** Along road to Mt Nardi, NE of Nimbin, 28°33′S, 153°18′E, Oct 1994, *Bean 7958* (BRI, MEL, NSW); Peates Mt road, Whian Whian S.F., N of Lismore, 28°35′S, 153°22′E, Sep 1994, *Bean 7920* (BRI); T-junction, 1.2 km N of Lowanna, W of Coffs Harbour, 30°12′S, 152°53′E, Sep 2000, *Bean 16876* (BRI, NSW); Dibbs Head, Dorrigo N.P., 30°22′S, 152°49′E, May 1994, *Bean 7712* (BRI, NSW); Whian Whian S.F., Gibbergunyah road, *c.* 30 km N Lismore, Nov 1992, *Read s.n.* (BRI [AQ580930], NE *n.v.*).

***Distribution and habitat*:** *Zieria southwellii* is found in the extreme south-east corner of the Southeast Queensland bioregion and in north-eastern NSW to as far south as Dorrigo N.P. In Qld, *Z. southwellii* is found in the Springbrook area and in Lamington N.P. (**Map 2**). Plants grow either in tall open eucalypt forest on rhyolitic or metamorphic substrates with canopy species that may include *Eucalyptus acmenoides*, *E. campanulata*, *E. grandis*, *E. microcorys*, *E. oreades*, *E. saligna* and *Lophostemon confertus* and midstorey species that include *Allocasuarina torulosa* and *Acacia orites,* or in simple moss-fern thicket on basalt substrates, with a very open canopy.

***Phenology*:** Flowers have been collected from August to December, and fruit in August.

***Conservation status*:** Armstrong (2002) considered that the "conservation status of this species cannot be reliably determined until more information is available". *Zieria southwellii* is common and widespread throughout its range, with large populations in National Parks at Dorrigo and Mt Warning in NSW, and Lamington in Qld. An appropriate conservation status is **Least Concern** (IUCN 2001).

32. Zieria tenuis Duretto & P.I.Forst. **species nova** a *Z. collina* C.T.White calycis lobis angusti-triangularis triangularibus (in illa late ovatis), petalis elliptico-ovatis et majoribus (2–2.5 mm longitudine) (in illa ovata ovatis et minoribus longitudine 1.2–2 mm) et coccis praeditis appendice apicali (adversus appendicem deficientem); et a *Z. cytisoides* Sm. foliolis angusti-ellipticis usque oblongis (adversum foliola elliptica usque obovata) ratione longitudinis latitudini 3.7–6 (adversum 1.8–3.3), indumento stellato-tomentoso coarcte in folii pagina inferiore (in illa hirta usque ad 1 mm longa longitudine) et venatione obscure obscura laterali in pagina abaxiali foliolorum (adversum venationem manifeste elevatam) differt. **Typus:** Queensland. Cook District: Agate Creek, Robinhood Station, SW of Forsayth, 18°50′S, 143°25′E, *P.I.Forster PIF19086, R.L.Jago, R.Jensen & T.Ryan*, 20 April 1996 (holo: BRI; iso: MEL 242485).

Zieria sp. (White Mt D.G.Fell+ DGF1257); Forster (2002: 181; 2007: 183).

Shrub to 1.5 m tall, forming an open straggly bush. Stems ± erect, wiry; branches without obvious decurrent leaf bases, weakly glandular verrucose, densely stellate-tomentose. Leaves palmately trifoliolate; petioles 5–18 mm long, sometimes weakly glandular verrucose, stellate tomentose; terminal leaflets oblong to narrow-elliptic, 9–32 × 2.5–7 mm, laminae not obviously glandular, tips obtuse, slightly mucronate, margins smooth, midribs raised abaxially, secondary veins slightly raised, adaxial surfaces with a sparse to dense cover of minute stellate-tomentose hairs, abaxial surfaces densely stellate-tomentose; lateral leaflets similar to terminal leaflets but smaller, 4–22 × 2–7 mm. Inflorescence axillary, shorter than the subtending leaf, 9–12-flowered, not obviously glandular, densely stellate-tomentose; peduncle 8–18 mm long; bracts linear-lanceolate, persistent, 1–3.2 mm long; secondary peduncles 3–4 mm long; pedicels 1–2.2 mm long. Sepals narrow-triangular, 1–2.5 × 0.7–1 mm, valvate in bud, not obviously glandular, tips acute to slightly acuminate, both surfaces stellate-tomentose. Petals elliptic-ovate, 2–2.5 × 0.9–1.5 mm, white or pink-white, valvate in bud, not obviously glandular, adaxial surfaces glabrous to glabrescent or with hairs along margins, abaxial surfaces with a moderately dense stellate indumentum. Staminal filaments *c.* 1 mm long, glabrous and eglandular; anthers *c.* 0.4 mm long, apiculum absent. Gynoecium glabrous. Cocci 2.5–3.5 × 1.5–1.8 mm, pellucid gland-dotted, glabrous, base of style persistent forming a minute apical apiculum. Seeds ovoid, 1.8–2.2 × 0.8–1 mm, black to dark brown, weakly longitudinally striate. **Fig. 15.**

***Additional specimens examined*: Queensland.** Cook District: Side gorge off Agate Creek, 18°50′S, 143°25′E, Apr 1996, *Jago 3968 & Forster* (BRI). Burke District: White Mountains [N.P.], N of Hughenden, 20°19′S, 144°49′E, Aug 1984, *Godwin C2722* (BRI); Junction of Rugged Gorge & side branch *c.* 6 km upstream from junction with Flinders River, White Mountains [N.P.], *c.* 60 km N of Torrens Creek, 20°23′S, 144°47′E, Apr 2000, *Thomas 1640 & Thompson* (BRI, DNA); White Mountains N.P., NW of Warang, 20°24′S, 144°47′E, Apr 2000, *Wannan 1702 & Martindell* (BRI, CANB, NSW); Branch of Warang Gorge, White Mountains N.P., 20°24′S, 144°48′E, Sep 1992, *Bean 5013* (BRI); White Mountains N.P., 1 km N of old Warang Homestead, 20°26′S, 144°49′E, 1998, *Johnson 2* (BRI); Bertya Creek, W of ‘Warang’, White Mountains N.P., 20°27′S, 144°46′E, Jun 1992, *Bean 4609* (AD, BRI, K, MEL, NSW, PERTH *n.v.*); Warang, White Mountains [N.P.], 37 km NNW of Torrens Creek, 20°29′S, 144°48′E, Jul 1988, *Fell DF1257* (BRI). North Kennedy District: Torrens Creek Gorge, White Mountains [N.P.], 20°26′S, 144°49′E, Jul 1991, *Cumming 11251* (BRI). Mitchell District: 41 km NW of Torrens Creek, 20°26′S, 144°50′E, Apr 1993, *Thompson HUG416 et al.* (BRI, NSW).

***Notes*:** *Zieria tenuis* appears to be allied to *Z. collina* and *Z. cytisoides.* It is remarkably similar on first appearances to *Z. collina*, a restricted species that is endemic to the Tamborine Mountain area of south-east Qld. *Z. collina* differs from *Z. tenuis* in the smaller, ovate petals that are 1.2–2 mm long (not 3.5 mm long as stated in Armstrong 2002) (versus larger elliptic-ovate petals that are 2–2.5 mm long), the broadly ovate calyx lobes (versus narrow-triangular), the cocci lacking an appendage (versus with an apical appendage) and being smaller (*c.* 2 mm long, versus 2.5–3.5 mm long). *Z. tenuis* differs from *Z. cytisoides* in the lateral venation in the leaflets being indistinct on the abaxial surface (versus prominently raised), the leaflets being narrow-elliptic to oblong (versus elliptic to obovate) with a length/width ratio of 3.7–6 (versus 1.8–3.3), the close stellate tomentose

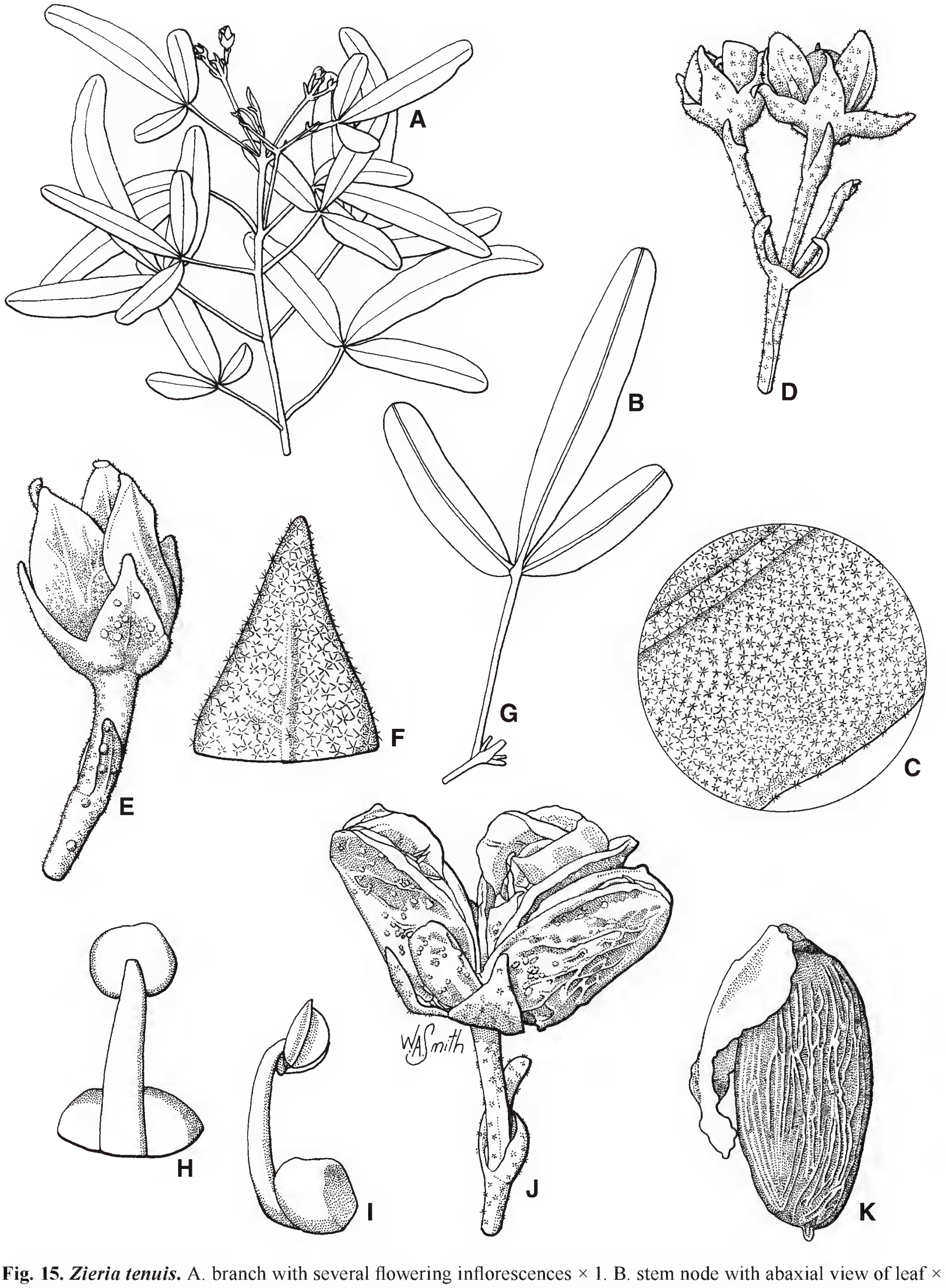


Fig. 15. ***Zieria tenuis.*** A. branch with several flowering inflorescences × 1. B. stem node with abaxial view of leaf × 2. C. detail on indumentum on abaxial surface of leaflet × 16. D. inflorescence with flowers × 6. E. flower × 8. F. tip of abaxial side of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. J. lateral view of seed × 16. A–D from *Forster PIF19086* (BRI); E–J from *Thomas 1640* (BRI). Del. W. Smith.

indumentum less than 0.2 mm long (versus a shaggy indumentum to 1 mm long), and smaller petals (2–2.5 mm long versus 3.6–6 mm long).

Some of the collections of *Zieria tenuis* from the White Mountains area have a less dense indumentum on the adaxial surface of the leaflets and one collection from Bertya Creek (*Bean 4609*) has smaller floral and vegetative parts than other specimens.

Distribution and habitat: *Zieria tenuis* is endemic to Qld within the Desert Uplands and Einasleigh Uplands bioregions where it is known from two widely disjunct areas: Agate Creek near Forsayth and the White Mountains, north of Torrens Creek (**Map 2**). The species is found growing on sandstone derived substrates in gorges or on alluvium under eucalypt woodland that includes the canopy species *Corymbia citriodora*, *C. leichhardtii*, *C. trachyphloia*, *Eucalyptus mediocris*, *Lophostemon grandiflorus* and *L. suaveolens*.

Phenology: Flowers and fruit have been collected from April to July.

Conservation status: There are numerous populations of *Zieria tenuis* protected within the White Mountains N.P. and the population on Robinhood Station is also secure for now. An appropriate conservation status is **Least Concern** (IUCN 2001).

Etymology: The specific epithet is derived from the Latin *tenuis*, and refers to the delicate inflorescence of the species (peduncles up to 18 mm long and only *c.* 0.5 mm wide).

33. Zieria vagans Duretto & P.I.Forst., **species nova** a *Z. verrucosa* J.A.Armstr. foliis patentibus vel erectis (in illa cernuis), foliolis anguste ellipticis (adversum linearia) ratione longitudinis latitudini 7.5–10.8 (adversus 10–25.3), supra non manifeste glandularibus (in illa valde glandulari-verrucosis) et sepalis non manifeste glandularibus (in illa dispersis glandularibus) differt. **Typus:** Queensland. Burnett District: Fontainea Scrub, Gurgeena Plateau, State Forest 172, 25°26′S, 151°23′E, 9 February 1994, *P.I.Forster PIF14801* (holo: BRI; iso: A, MEL 306447, MO, NSW).

Zieria sp. (Binjour P.I.Forster PIF14134); Forster (1997b: 188; 2002: 181; 2007: 183).

Shrub to 2 m tall, forming an open, straggly bush. Stems erect to weakly decumbent; young branches without decurrent leaf bases, markedly glandular verrucose, densely stellate-tomentose. Leaves palmately trifoliolate; petioles 5–13 mm long, glandular verrucose, densely stellate-tomentose; terminal leaflets narrowly elliptic, 32–45 × 3.5–5.5 mm, tips obtuse, margins smooth to glandular dentate, midribs and some secondary veins raised abaxially, midribs glandular verrucose, adaxial surfaces not obviously glandular (apart from being pellucid gland dotted), glabrous or with a sparse indumentum of simple and/or stellate hairs, abaxial surfaces glandular verrucose, densely stellate-tomentose; lateral leaflets similar to terminal leaflets but usually smaller, 23–36 × 3.5–4.5 mm. Inflorescence axillary, shorter than the subtending leaf, 3–15-flowered, glandular verrucose, densely stellate-tomentose apart from pedicels; peduncle 5–13 mm long; bracts narrow-oblong, persistent, 1–6 mm long; secondary peduncles 1–4 mm long; pedicels 2–4 mm long, with a sparse stellate indumentum. Sepals deltate, 0.8–1 × 0.8–1 mm, valvate in bud, not obviously glandular, tips acute, adaxial surfaces glabrous apart from puberulous margins, abaxial surfaces with a sparse to dense stellate and simple indumentum that becomes denser along margins. Petals elliptic, *c.* 2 × 1.2–1.3 mm, cream-white, valvate in bud, not obviously glandular, adaxial surfaces minutely pilose, abaxial surfaces with a moderately dense simple and stellate indumentum. Staminal filaments 0.8–1 mm long, glabrous or glabrescent with simple or stellate hairs, weakly glandular verrucose distally; anthers *c.* 0.4 mm long, apiculum absent. Gynoecium glabrous. Cocci 2.5–4.5 × 1.6–2.2 mm, smooth, glabrous, base of style not persistent. Seeds ovoid, 2–2.2 × 1–1.4 mm, grey-black to black-purple, dull, faintly longitudinally striated. **Fig. 16.**

Additional specimens examined: **Queensland.** Burnett District: S.F. on Binjour Plateau, Oct 1987, *Bean 671* (BRI); S.F. 172, Binjour Plateau, Sep 1989, *Forster PIF5730 & Bean* (BRI); Binjour Plateau, S.F. 172, near Meredith's road, Oct 1993, *Forster PIF14134* (A, AD,

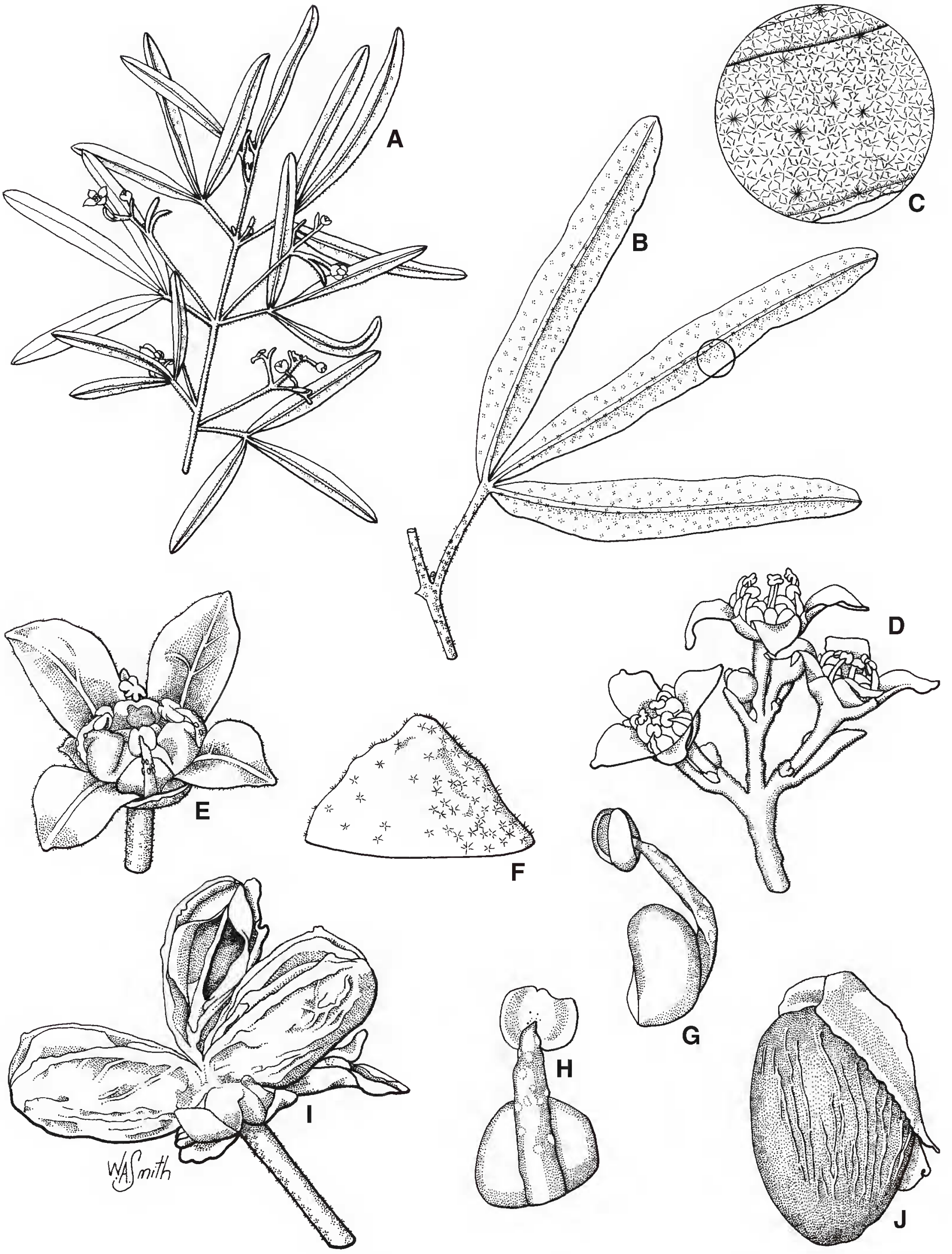


Fig. 16. ***Zieria vagans.*** A. branch with several flowering inflorescences × 1. B. node with abaxial view of leaf × 2. C. detail of indumentum on abaxial surface of leaflet × 16. D. inflorescence with buds & flowers × 4. E. flower × 8. F. tip of abaxial side of sepal × 20. G–H. views of stamens × 20. I. mature fruit with multiple cocci × 8. J. lateral view of seed × 16. A–C, I–J from *Forster PIF15065* (BRI); D–H from *Forster PIF14801* (BRI). Del. W. Smith.

BRI, DNA, L, MEL, MO, NSW, NY); Fontainea Scrub, S.F. 172, Gurgeena Plateau, Mar 1994, *Forster PIF15065* (A, BRI, L, MEL, NE); Orchid Scrub, Gurgeena Plateau, S.F. 172, Dec 1996, *Forster PIF20122* (BRI, MEL).

Notes: As noted under *Zieria distans*, together with *Z. verrucosa,* this species forms part of a threesome of closely related taxa. *Z. vagans* differs from *Z. verrucosa* in the leaves that are held patently or erect (versus drooping), the leaflets that are narrow-elliptic (versus linear) with a length/width ratio of 7.5–10.8 (versus 10–25.3) and that are not obviously glandular above (versus strongly glandular verrucose) and the not obviously glandular sepals (versus scattered glandular verrucose). Both *Z. vagans* and *Z. verrucosa* share similar sized leaves and narrow-oblong bracts on the inflorescences. Differences between *Z. distans* and *Z. vagans* are outlined in the notes under the former.

Distribution and habitat: *Zieria vagans* is endemic to Qld within the Brigalow Belt bioregion and is confined to the central Burnett district where all collections have been made on the Gurgeena Plateau near Binjour (**Map 2**). The Gurgeena Plateau is a relictual plateau with a lateritised duricrust. On the Gurgeena Plateau this species occurs as an understorey component in semi-evergreen vinethicket dominated by *Backhousia kingii* on red soils or in the ecotone between this community and adjacent eucalypt woodland.

Phenology: Flowers have been collected from October to March, and fruit from December to March.

Conservation status: On the Gurgeena Plateau there appear to be only two populations of *Zieria vagans*, both within S.F. 172. The population near Meredith's Road in S.F. 172 co-occurs with another endangered species, *Fontainea fugax* P.I.Forst. Direct threats to these populations include grazing from stock and fire. At the Meredith's Road site, there are the beginnings of infestations by environmental weeds such as *Aristolochia elegans* (Dutchman's pipe). *Z. vagans* has a total area of occupancy of less than 5 ha. This species is listed as **Endangered** in Qld (*NCR* 2006) and fulfils the IUCN criteria of A1(c), B2a, c(iv), C2b. (IUCN 2001).

Etymology: The specific epithet is derived from the Latin *vagans* (wandering, unsettled) and alludes to the existence of some populations of this species on the fire prone ecotone between eucalypt woodland and semi-evergreen vinethicket.

34. Zieria verrucosa J.A.Armstr., *Austral. Syst. Bot.* 15: 456 (2002). **Type:** Queensland. BURNETT DISTRICT: West of Proston, July 1949, *L.J.Webb 5068* (holo: BRI; iso: BRI).

Zieria sp. 1; Ross (1983: 442).

Zieria sp. (Monogorilby P.I. Forster PIF1004); Forster (1997b: 188; 2002: 181).

Illustrations: Armstrong (2002: 454, 455).

Addition to description given by Armstrong (2002): Cocci 2.5–3.5 × 1.8–2.2 mm, smooth, with apiculate tip and weakly longitudinally striate. Seeds ovoid, 1.9–2 × 1.1–1.2 wide, black to dark brown, shiny, longitudinally striated.

Additional specimens examined: **Queensland.** BURNETT DISTRICT: Narayen Research Station, Mundubbera, 25°35′S, 151°17′E, Oct 1977, *Hargraves s.n.* (CANB); 'Narayen', *c.* 30 miles [50 km] W of Mundubbera, 25°36′S, 150°50′E, Dec 1967, *Tothill N418* (BRI); 'Narayen', Dec 1967, *McHarg N418* (BRI); 3.5 km NNE of Monogorilby, 26°02′S, 151°00′E, Sep 1994, *Forster PIF15823* (BRI, MEL, NSW); 3.5 km N of Monogorilby, 26°02′S, 151°01′E, Dec 1981, *Forster PIF1004* (BRI, CANB, NSW); 3 km N of Monogorilby, 26°02′S, 151°01′E, Aug 1989, *Forster PIF5646* (BRI, CANB, DNA, MEL); Speedwell, N of Proston, 26°02′S, 151°32′E, Mar 1997, *Bean 11807* (BRI, MEL); Stalworth road, north of Proston, 26°07′S, 151°36′E, Sep 1996, *Bean 10672* (BRI); *loc. cit.*, Nov 1996, *Bean 11360* (BRI, MEL); Abbeywood, Abbeywood road, 2 km S of Proston, 26°07′S, 151°37′E, Jun 1994, *Thomas 329 & Sinclair* (BRI); 2 km S of Abbeywood, on Proston road, 26°08′S, 151°37′E, Aug 1989, *Forster PIF5655* (BRI, CANB, MEL); Reinke's Scrub, 1.5 km SW of Proston, 26°10′S, 151°35′E, Aug 1991, *Forster PIF9096* (AD, BRI, L, MEL, MO, NSW, NY); 2.5 km from Proston, on road to weir, 26°10′S, 151°35′E, May 1996, *Bean 10284* (BRI); Proston Town Reserve, Aug 1989, 26°10′S, 151°36′E, Aug 1989, *Forster PIF5656* (BRI, MEL); Nanango area, 26°45′S, 152°05′E, Feb 2002, *Fox s.n.* (BRI [AQ553293]).

Typification: There appears to be slight confusion in citation of some collections for this species by Armstrong (2002). As type he gives *L.J.Webb 5068* from 'West of Proston', then in the '*Specimens examined*' he cites the collection twice, once with this locality, and the second with 'Monogorilby, W of Proston'. Certainly, this is how the two sheets of *Webb 5068* are labelled, but it is unlikely that they represent different localities. It is perhaps most likely that the type collection was actually from Monogorilby as Webb visited there for the purposes of vegetation survey, although as the species is known to occur at both Monogorilby and Proston, the origin of the specimen cannot be accurately determined.

***Notes*:** Many more specimens are now available of this species than were cited or examined by Armstrong (1991a, 2002) and it is possible to provide fruit and seed descriptions as given above.

***Distribution and habitat*:** *Zieria verrucosa* is endemic to Qld within the Brigalow Belt and Southeast Queensland bioregions with populations centred near Abbeywood, Proston, Monogorilby, 'Narayen' and Nanango (**Map 4**). This species usually occurs in semi-evergreen vinethicket on red krasnozem soil. At Nanango it is in *Eucalyptus crebra* woodland on red clay soil. The plants are often abundant in open areas of the understorey and more so where the vegetation has been disturbed or has regrown after clearing.

***Phenology*:** Flowers and fruit have been collected from August to February.

***Conservation status*:** This species is listed as **Vulnerable** in Qld (*NCR* 2006). The species distribution is now reliably determined (*cf.* Armstrong 2002) and this coding is appropriate for the species, although it may require upgrading to Endangered. Major threats to the species continue to be land clearing for agricultural and destruction of populations on roadsides or in regrowth on private freehold land. No populations occur in conservation reserves and the only population that is probably reasonably secure is the small one on 'Narayen'. The population at Proston in the town reserve is badly degraded with extensive damage and weed infestation. The populations at Monogorilby, Stalworth Road, Speedwell and near Abbeywood are all on roadsides, or on private freehold land (usually in regrowth) and have no real protection in areas that are intensively cultivated or maintained for cattle grazing.

35. Zieria whitei J.A.Armstr. ex Duretto & P.I.Forst., **nom. et stat. nov.**; *Zieria aspalathoides* var. *intermedia* C.T.White, *Proc. Roy. Soc. Queensland* 53: 209 (1942). **Type:** Queensland. North Kennedy District: Ravenshoe, June 1913, *E.W.Bick 116* (holo: BRI [AQ520881 – 2 sheets]).

Zieria sp. (Ravenshoe E.W.Bick 116); Forster (1997b: 188).

Shrub to 50 cm tall, forming a densely compact bush. Stems erect, wiry; branches without or with slightly decurrent leaf bases, not glandular verrucose, pubescent with mainly stellate hairs but also with simple, bifid and a few trifid hairs. Leaves palmately trifoliolate (though first pair of leaves on secondary shoots simple and up to 4 mm wide), not glandular verrucose; petioles 0.5–1 mm long, stellate pubescent; terminal leaflets narrow elliptic to narrow oblanceolate, 5–10 × 1–2.5(3) mm, tips acute, margins mostly recurved to revolute, sometimes flat, midribs raised abaxially, secondary veins obscure, adaxial surfaces sparsely pilose to pilose with simple and bifid hairs, sometimes hairs confined to midribs, abaxial surfaces with a moderately dense indumentum of stellate hairs with a few simple hairs; lateral leaflets similar to terminal leaflets. Inflorescence axillary, longer than the subtending leaf, usually 3-flowered, not glandular verrucose, with a moderately dense stellate indumentum; peduncle 3–14 mm long; bracts narrow-elliptic to narrow-lanceolate, persistent, 1–2 mm long; pedicels 2–3 mm long. Sepals ovate-deltate, 1.5–2 × 0.7–2 mm, valvate in bud, slightly glandular verrucose, tips acute, adaxial surfaces with scattered simple and bifid appressed hairs, abaxial surfaces glabrescent or with a dense indumentum of stellate hairs. Petals elliptic, 2.5–3 × *c.* 1.5 mm, white to pale pink, valvate in bud, not obviously glandular, adaxial surfaces glabrescent, abaxial surfaces with a dense indumentum of stellate hairs. Staminal filaments *c.* 1.2 mm long, glabrescent, slightly glandular verrucose at apex; anthers *c.* 0.6 mm long, apiculum minute. Ovary glabrous or with a stellate indumentum; style glabrous. Cocci *c.* 3.5 × 2 mm, smooth to slightly glandular verrucose, glabrous or with scattered stellate hairs. Seeds not observed. **Fig. 17.**

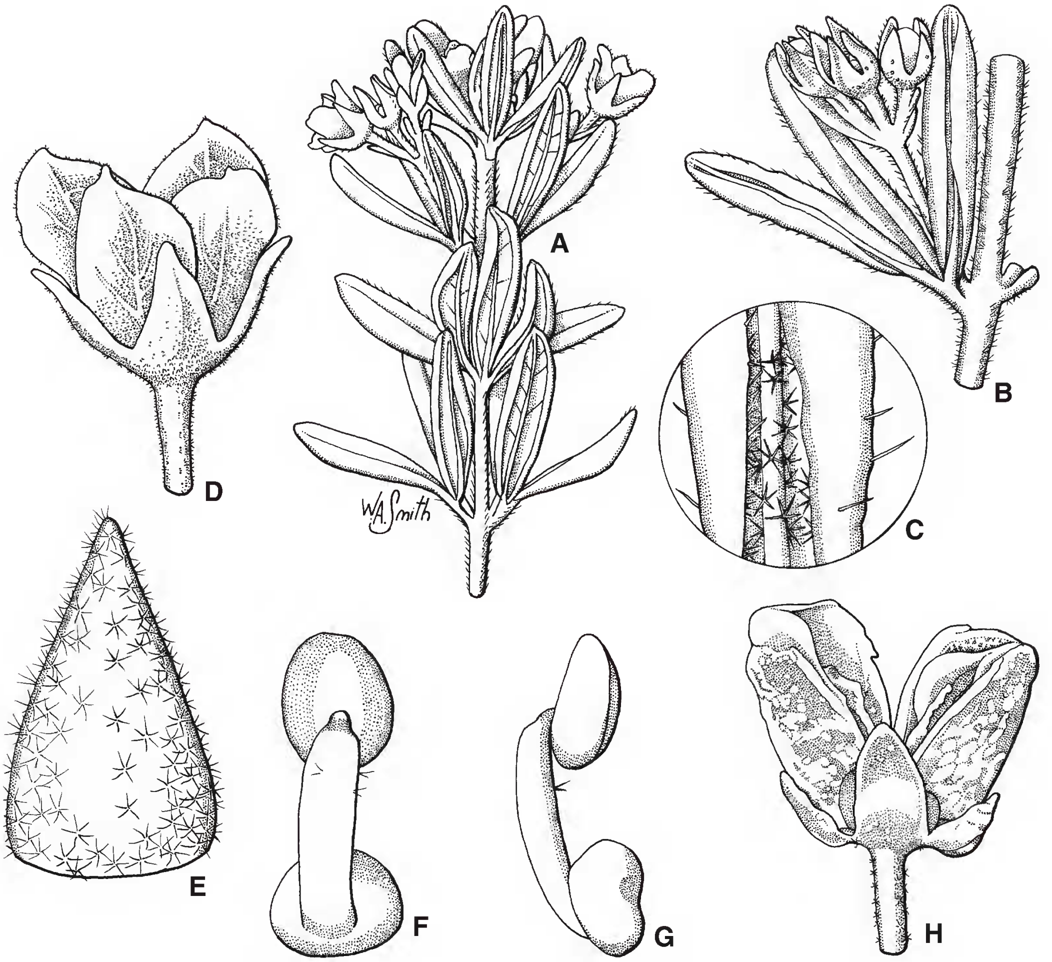


Fig. 17. ***Zieria whitei.*** A. branch with several flowering inflorescences × 2. B. node with abaxial view of leaf and single inflorescence with bud and flower × 4. C. detail of indumentum on abaxial surface of leaflet × 16. D. flower × 8. E. tip of abaxial side of sepal × 20. F–G. views of stamens × 20. I. mature fruit with multiple cocci × 8. A–G from *Forster PIF30695* (BRI); H from *McDonald KRM2964* (BRI). Del. W. Smith.

Additional specimens examined**: Queensland.** Cook District: Near Mt Emerald, SW of Walkamin, 17°11′S, 145°22′E, Jul 1998, *Bean 13750* (BRI); near boundary of Mt Baldy S.F., Western L.A., 17°16′S, 145°21′E, Jul 2004, *McDonald KRM2964 & Bean* (BRI). North Kennedy District: Headwaters Archer Creek, *c.* 3 miles [*c.* 5 km] WNW of Ravenshoe, Jul 1978, *Lockyer 3* (NSW); Bald Rock, *c.* 1.3 miles [*c.* 2 km] WSW of Ravenshoe, May 1975, *Lockyer 67* (NSW); Bald Rock, eastern slopes, S.F. 511, W of Ravenshoe, 17°36′S, 145°27′E, Jul 2004, *McDonald KRM2969* (BRI); S.F. 511, Bald Rock, near Ravenshoe, 17°36′S, 145°27′E, Apr 2005, *Forster PIF30695 & McDonald* (BRI, HO); S.F.R. 488, 2.5 km S of Ravenshoe, off Wooroora road, 17°38′S, 145°29′E, May 2001, *Ford AF2808 et al.* (BRI, MEL).

Notes**:** White (1942) named a number of new taxa in *Zieria*, including this one as a variety of *Z. aspalathoides*. At the same time he also named *Z. aspalathoides* var. *obovatum* C.T.White, subsequently recognised as *Z. obovata* by Armstrong (2002). *Z. aspalathoides* var. *intermedia* was omitted from the monograph by Armstrong (2002), although he indicated in a footnote on p. 277 that this was a new species. He also annotated the type specimen (this comprises two individuals on two sheets) at BRI in 1992 with the name *Z. whitei* J.A.Armstr. ms. and labels that said 'Lectotype' and 'Isolectotype' respectively. White (1942) quite clearly states that the type collection for his new variety was *E.W.Bick 116*. Although two individual pieces are represented in the collection, we consider them to be part of the same gathering and so do not consider that lectotypification of the name is necessary.

Zieria whitei is clearly allied to *Z. aspalathoides* but differs from that species in having a stellate indumentum on the stems, abaxial surface of the leaves and the abaxial surface of the sepals.

***Distribution and habitat*:** *Zieria whitei* is endemic to Qld within the Einasleigh Uplands bioregion and is known from several populations near Atherton and Ravenshoe (**Map 3**). It has been collected in rocky situations (rhyolite) in tall heathy shrubland or woodland with *Corymbia abergiana*, *Eucalyptus lockyeri*, *E. pachycalyx*, *E. reducta* and *Syncarpia glomulifera* common as overstorey dominants, and associated species including *Allocasuarina torulosa*, *Borya nitida*, *Homoranthus porteri*, *Leptospermum amboinense*, *Prostanthera clotteniana*, *Pseudanthus pimeleoides* and *Persoonia tropica*.

***Phenology*:** Flowers have been collected from May to July, and fruits in June.

***Conservation status*:** The habitat of *Zieria whitei* is poorly known and because of its inconspicuous nature may be undercollected, rather than actually rare. Five populations are currently known and there are no records from conservation reserves at this stage. A conservation status of **Vulnerable** based on the criteria B2a,b(i-v), D2 (IUCN 2001) is appropriate. Surveys are required to determine the number of populations, number of individuals and an area of occupancy. It co-occurs with the Endangered *Prostranthera clotteniana* at one locality.

***Etymology*:** This epithet was coined by Armstrong to honour C.T. White (1890–1950) past Government Botanist of Queensland who named a number of new taxa of *Zieria*.

Acknowledgements

We would like to thank Tony Bean and Glenn Leiper for their continued enthusiastic collecting of Zierias; Will Smith for the illustrations; Peter Bostock for translation of the diagnoses into Latin; the Directors of CANB, MEL, NE and NSW for the loan of material; Joy Brushe for information on the geology of Mt Larcom; Juliet Wege, as the Australian Botanical Liason Officer, for locating types at K, BM and LINN and organising images to be taken of these specimens; and The Board of Trustees of RBG Kew for allowing images of various types to be used for this research.

References

Armstrong, J.A. (1991a). *Studies on pollination and systematics in the Australian Rutaceae*. Ph.D thesis, The University of New South Wales.

—— (1991b). *Zieria*. In G. Harden (Ed.) *Flora of New South Wales* 2: 36–246. The University of New South Wales Press: Sydney.

—— (2002). *Zieria* (Rutaceae): a systematic and evolutionary study. *Australian Systematic Botany* 15: 277–463.

Armstrong, J.A. & Harden, G.J. (2002). *Zieria*. In G. Harden (ed.) *Flora of New South Wales*, 2nd edition, 2: 277–288. The University of New South Wales Press: Sydney.

Auld, T.D. (2001). The ecology of the Rutaceae of the Sydney region of south-eastern Australia: poorly known ecology of a neglected family. *Cunninghamia* 7: 213–239.

Benson, D. & Mcdougall, L. (2001). Ecology of Sydney plant species Part 8 Dicotyledon families Rutaceae to Zygophyllaceae. *Cunninghamia* 7: 241–462.

Briggs, J.D. & Leigh, J.H. (1996). *Rare or Threatened Australian Plants*. Revised edition. CSIRO Australia: Collingwood.

Burke, A. (2003). Inselbergs in a changing world – global trends. *Diversity & Distributions* 9: 375–383.

Clarke, P.J. (2002a). Habitat insularity and fire response traits: evidence from a sclerophyll archipelago. *Oecologia* 132: 582–591.

Clarke, P.J. (2002b). Habitat islands in fire-prone vegetation: do landscape features influence community composition? *J. Biogeography* 29: 677–684.

Duretto, M.F. (1997). Taxonomic notes on *Boronia* of north-western Australia, including a revision of the *Boronia lanuginosa* group (*Boronia* section *Valvatae*, Rutaceae). *Nuytsia* 11: 301–346.

—— (1999a). *Boronia* sect. *Valvatae* (Benth.) Engl. (Rutaceae) in Queensland, Australia. *Austrobaileya* 5: 263–298.

—— (1999b). Systematics of *Boronia* section *Valvatae sensu lato* (Rutaceae). *Muelleria* 12: 1–131.

—— (2003). Notes on *Boronia* (Rutaceae) in eastern and northern Australia. *Muelleria* 17: 19–135.

Duretto, M.F., Grimshaw, P. & Sparshott, K. (2005). The rediscovery of *Boronia inflexa* subsp. *grandiflora* (Rutaceae). *Austrobaileya* 17: 171–173.

Duretto, M.F. & Ladiges, P.Y. (1997). Morphological variation within the *Boronia grandisepala* group (Rutaceae) and the description of nine taxa endemic to the Northern Territory, Australia. *Australian Systematic Botany* 10: 249–302.

Fitzsimmons, L.E. (1999). Management of *Zieria collina* C.T.White. Unpublished Master of Natural Resources Thesis. University of New England: Armidale.

Forster, P.I. (1994a). Ten new species of *Plectranthus* L'Her. (Lamiaceae) from Queensland. *Austrobaileya* 4: 159–186.

—— (1994b). Flora of the Scenic Rim. Bill Tulloch Memorial Lecture 1994. *Society for Growing Australian Plants (Queensland Region Inc.) Bulletin* 33: 29–36.

—— (1997a). *Plectranthus amoenus* and *P. thalassoscopicus* (Lamiaceae), new species from north-eastern Queensland, Australia. *Austrobaileya* 4: 653–660.

—— (1997b). Rutaceae. In R.J.F.Henderson (ed.), *Queensland Plants: names and distribution*, pp. 184–188. Queensland Department of Environment and Heritage: Brisbane.

—— (2002). Rutaceae. In R.J.F.Henderson (ed.), *Names and distribution of Queensland Plants, Algae and Lichens*, pp. 177–181. Environmental Protection Agency: Brisbane.

—— (2003). *Phebalium distans* P.I.Forst. (Rutaceae), a new and endangered species from south-eastern Queensland, and reinstatement of *P. longifolium* S.T.Blake. *Austrobaileya* 6: 437–444.

—— (2005). New species of *Philotheca* Rudge (Rutaceae) from Queensland. *Austrobaileya* 7: 175–181.

—— (2007). Rutaceae. In P.D.Bostock & A.E.Holland (eds.), *Census of the Queensland Flora 2007*, pp. 180–183. Environmental Protection Agency: Brisbane.

Haslam, S. (2004). *Noosa's Native Plants.* Noosa Integrated Catchment Association Inc.: Tewantin.

Hauser, J. & Blok, J. (1998). *Fragments of Green.* 2nd edition. Australian Rainforest Conservation Society: Bardon.

Hogbin, P.M. & Peakall, R. (1999). Evaluation of the contribution of genetic research to the management of the endangered plant *Zieria prostrata*. *Conservation Biology* 13: 514–522.

Hopper, S.D., Brown, A.P. & Marchant, N.G. (1997). Plants of Western Australian granite outcrops. *Journal of the Royal Society of Western Australia* 80: 141–158.

Iucn (2001). *IUCN Red List Categories and Criteria.* Version 3.1. IUCN Species Survival Commission. IUCN: Gland, Switzerland and Cambridge, UK.

Leiper, G. (2002). Survey of *Zieria furfuracea* subsp. "Belmont" populations at Belmont Hills Bushland complex. Unpublished report to Brisbane City Council. G & J Leiper Environmental Services: Beenleigh.

Logan River Branch Sgap (Qld Region) Inc. (2002). *Mangroves to Mountains. A field guide to the native plants of the Logan – Albert Rivers catchment.* Copyright Publishing Co. Pty Ltd.: Brisbane.

—— (2005). *Mangroves to Mountains.* Vol. 2, *A field guide to the native plants of South-east Queensland.* Logan River Branch SGAP (QLD Region) Inc.: Browns Plains.

Pearson, S. & Pearson, A. (1989). *Plants of Central Queensland.* Society for Growing Australian Plants, NSW Ltd.: Sydney.

—— (1992). *Rainforest Plants of Eastern Australia.* Kangaroo Press: Kenthurst.

Porembski, S. & Barthlott, W. (2000). (eds.) *Inselbergs – biotic diversity of isolated rock outcrops in tropical and temperate regions.* Springer-Verlag: Berlin.

Porembski, S., Becker, U. & Seine, R. (2000). Islands on islands: habitats on inselbergs. In S.Porembski & W.Barthlott (eds.), *Inselbergs – biotic diversity of isolated rock outcrops in tropical and temperate regions*, pp. 49–67. Springer-Verlag: Berlin.

Porembski, S., Seine, R. & Barthlott, W. (1997). Inselberg vegetation and the biodiversity of granite outcrops. *Journal of the Royal Society of Western Australia* 80: 193–199.

Ross, E.M. (1983). Rutaceae. In T.D.Stanley & E.M.Ross, Flora of South-eastern Queensland. Vol. 1: 440–470. Queensland Department of Primary Industries: Brisbane.

Sattler, P. & Williams, R. (1999). (eds.) *The Conservation Status of Queensland's Bioregional Ecosystems.* Environmental Protection Agency: Brisbane.

Savolainen, V. & Forest, F. (2005). Species–level phylogenetics from continental biodiversity hotspots. In F.T.Bakker, L.W.Chatrou, B.Gravendeel & P.B.Pelser (eds.), *Plant Species–Level Systematics: New Perspectives on Pattern and Process*, pp. 17–30. A.R.G.Ganter Verlag K.G.: Ruggell.

Sharma, I.K. (2001). Understanding clonal diversity patterns through allozyme polymorphism in an endangered and geographically restricted Australian shrub, *Zieria baeuerlenii* and its implications for conservation. *Biochemical Systematics & Ecology* 29: 681–695.

Telford, I.R. (1990). Moving mountains – Allan Cunningham and the mountains of southern Queensland. In P.S.Short (ed.), *History of Systematic Botany in Australasia*, p. 157. Australian Systematic Botany Society Inc.: Melbourne.

White, C.T. (1942). Contributions to the Queensland flora, No. 7. *Proceedings of the Royal Society of Queensland* 43: 201–228.

Williams, K.A.W. (1979). *Native Plants of Queensland.* Vol. 1. K.A.W.Williams: North Ipswich.

—— (1984). *Native Plants of Queensland.* Vol. 2. K.A.W.Williams: North Ipswich.

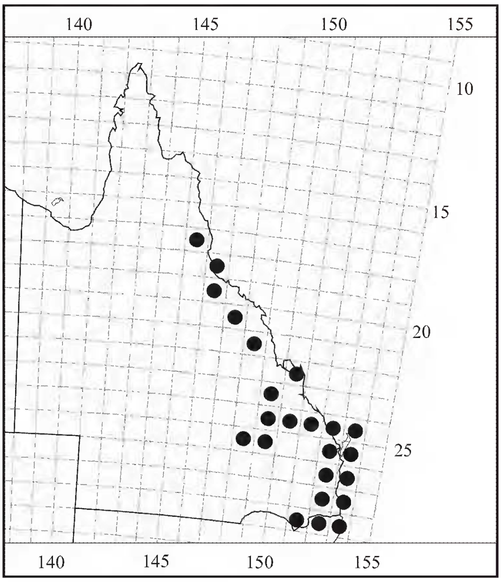
—— (1987). *Native Plants of Queensland.* Vol. 3. K.A.W.Williams: North Ipswich.

—— (1999). *Native Plants of Queensland.* Vol. 4. K.A.W.Williams: North Ipswich.

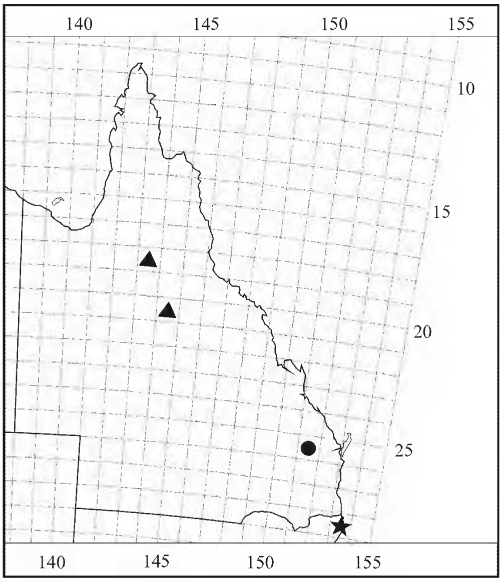
Willmott, W. (2004). *Rocks and Landscapes of the National Parks of southern Queensland.* Geological Society of Australia, Queensland Division: Brisbane.

—— (2006). *Rocks and Landscapes of the National Parks of central Queensland.* Geological Society of Australia, Queensland Division: Brisbane.

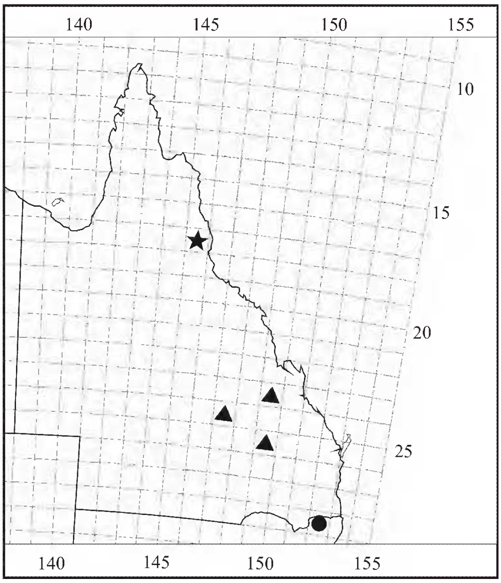
Distribution of *Zieria* species in 1° grid squares within Queensland.



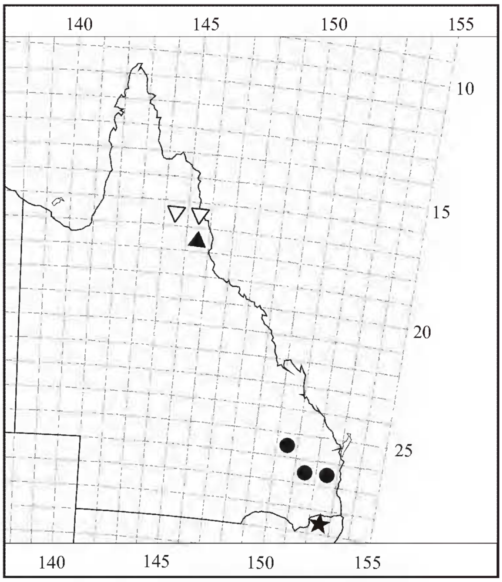
Map 1. *Zieria smithii* ●.



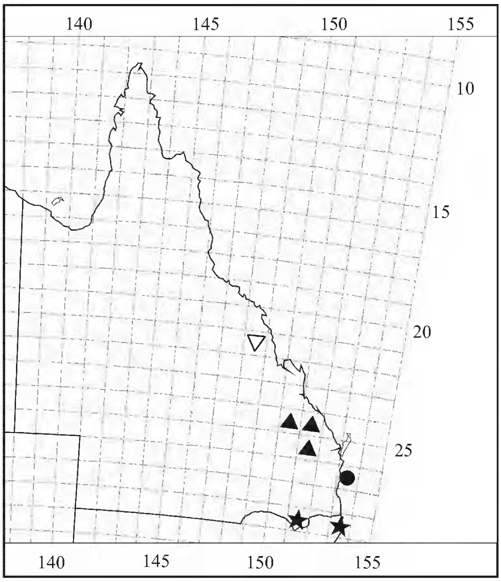
Map 2. *Zieria southwellii* ★, *Z. tenuis* ▲ and *Z. vagans* ●.



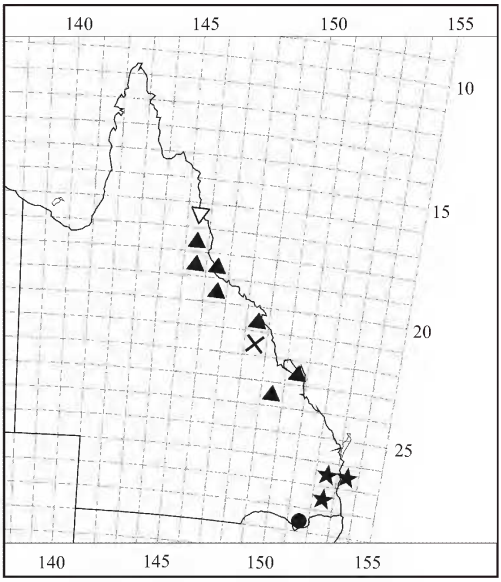
Map 3. *Zieria fraseri* subsp. *fraseri* ●, *Z. fraseri* subsp. *robusta* ▲ and *Z. whitei* ★.



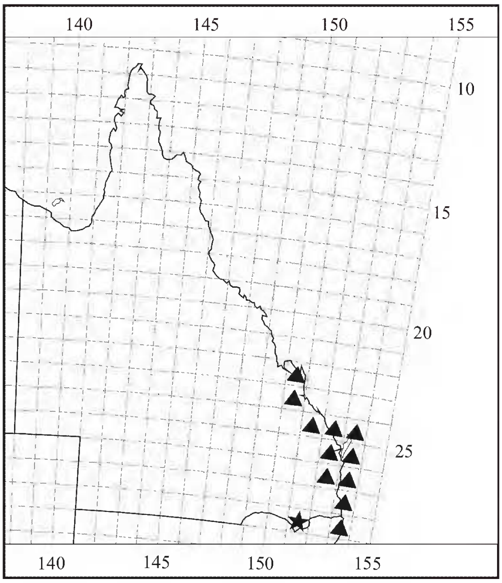
Map 4. *Zieria montana* ★, *Z. obovata* ▲, *Z. rimulosa* ▽ and *Z. verrucosa* ●.



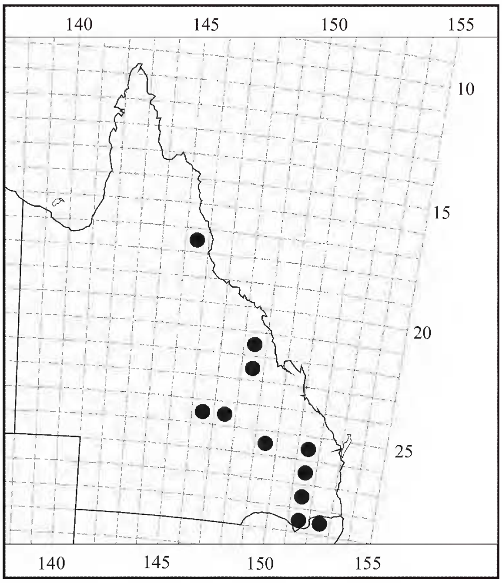
Map 5. *Zieria arborescens* subsp. *arborescens* ★, *Z. distans* ▲, *Z. eungellaensis* ▽ and *Z. exsul* ●.



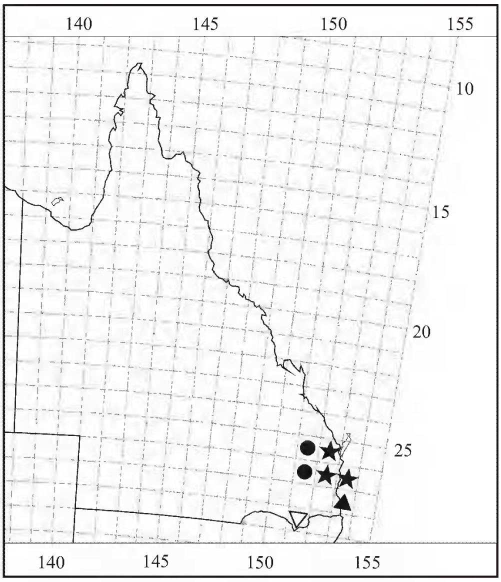
Map 6. *Zieria arborescens* subsp. *glabrifolia* ●, *Z. cephalophila* ✕, *Z. insularis* ▽, *Z. madida* ▽, *Z. minutiflora* subsp. *minutiflora* ★, *Z. minutiflora* subsp. *trichocarpa* ▲.



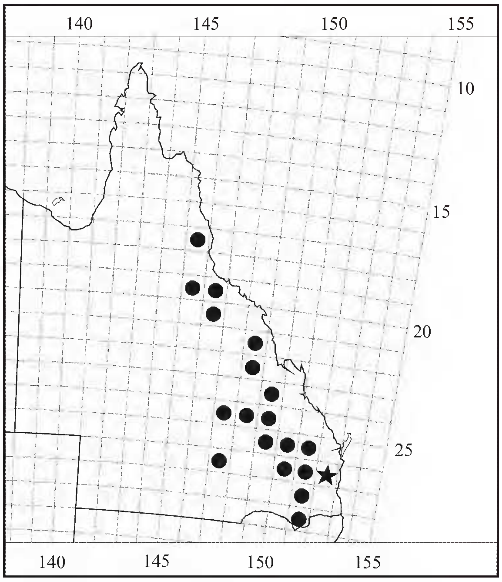
Map 7. *Zieria laevigata* ★ and *Z. laxiflora* ▲.



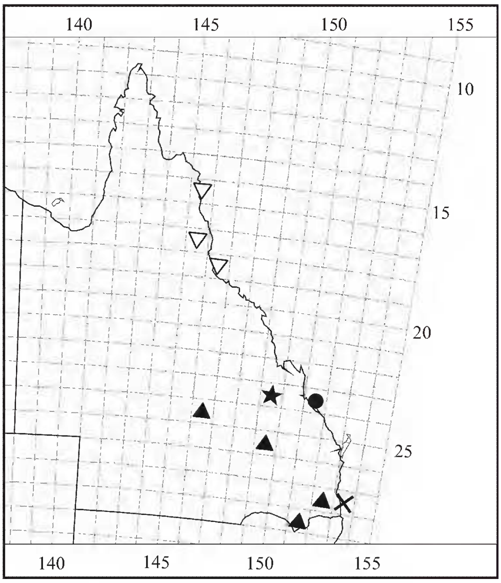
Map 8. *Zieria cytisoides* ●.



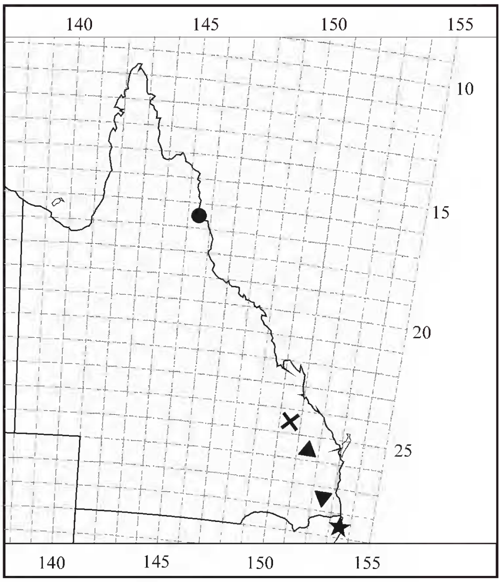
Map 9. *Zieria furfuracea* subsp. *enthadenia* ★, *Z. furfuracea* subsp. *gymnocarpa* ▲, *Z. graniticola* ▽, and *Z. inexpectata* ●.



Map 10. *Zieria aspalathoides* subsp. *aspalathoides* ●, and *Z. bifida* ★.



Map 11. *Zieria actites* ●, *Z. aspalathoides* subsp. *brachyphylla* ★, *Z. collina* ✕, *Z. compacta* ▲, and *Z. robertsiorum* ▽.



Map 12. *Zieria adenodonta* ★, *Z. alata* ●, *Z. boolbunda* ▲, *Z. hydroscopica* ✕ *and Z. scopulus* ▼.

Index to Scientific Names: Accepted names are in **bold Roman type** and synonyms etc. are in *italics*. The page number following the name refers to the main entry for each name.

Boronia minutiflora F.Muell. 520
Zieria actites Duretto & P.I.Forst. 480
Zieria adenodonta (F.Muell.) J.A.Armstr.. 482
Zieria alata Duretto & P.I.Forst.. 482
Zieria arborescens Sims 485
Zieria arborescens subsp. **arborescens** 485
Zieria arborescens subsp. **glabrifolia** J.A.Armstr. 485
Zieria aspalathoides A.Cunn. ex Benth. 486
Zieria aspalathoides subsp. **aspalathoides** 487
Zieria aspalathoides subsp. **brachyphylla** 488
Zieria aspalathoides var. *intermedia* C.T.White 536
Zieria aspalathoides var. *obovatum* C.T.White. 524
Zieria aspalathoides var. (Springsure L.Cockburn AQ195493) 487
Zieria bifida Duretto & P.I.Forst. 488
Zieria boolbunda Duretto & P.I.Forst 491
Zieria cephalophila Duretto & P.I.Forst. 492
Zieria collina C.T.White 494
Zieria compacta C.T.White 495
Zieria compacta var. *glabrata* C.T.White. 506
Zieria compacta var. *robusta* C.T.White 506
Zieria cytisoides Sm.. 497
Zieria distans Duretto & P.I.Forst 497
Zieria eungellaensis Duretto & P.I.Forst. 500
Zieria exsul Duretto & P.I.Forst.. 502
Zieria fraseri Hook. 503
Zieria fraseri subsp. *compacta* (C.T.White) J.A.Armstr.. 495

Zieria fraseri subsp. **fraseri** 506
Zieria fraseri subsp. **robusta** (C.T.White) Duretto & P.I.Forst. 506
Zieria furfuracea R.Br. ex Benth. 508
Zieria furfuracea subsp. (Belmont Scrub Anon. AQ152898) 509
Zieria furfuracea subsp. (Kin Kin V.K.Moriarty 134) 508
Zieria furfuracea subsp. **euthadenia** J.A.Armstr. 508
Zieria furfuracea subsp. **gymnocarpa** J.A.Armstr. 509
Zieria granulata var. *adenodonta* F.Muell.. 482
Zieria graniticola Duretto & P.I.Forst. 509
Zieria granulata var. *adenodonta* F.Muell.. 482
Zieria hydroscopica Duretto & P.I.Forst. 512
Zieria inexpectata Duretto & P.I.Forst. 514
Zieria insularis Duretto & P.I.Forst.. 516
Zieria laevigata Bonpl.. 518
Zieria laevigata Sm. var. *fraseri* (Hook.) Domin. 503
Zieria laevigata subsp. (Wyberba T.L.Ryan 37) 518
Zieria laevigata var. *laxiflora* Benth.. 518
Zieria laxiflora (Benth.) Domin 518
Zieria madida Duretto & P.I.Forst. 519
Zieria minutiflora Domin 520
Zieria minutiflora subsp. (Danbulla L.J.Webb 5732) 522
Zieria minutiflora subsp. **minutiflora** 522
Zieria minutiflora subsp. **trichocarpa** 522
Zieria montana J.A.Armstr. 523
Zieria obovata (C.T.White) J.A.Armstr. 524
Zieria rimulosa C.T.White 525
Zieria robertsiorum J.A.Armstr. 525
Zieria scopulus Duretto & P.I.Forst.. 527
Zieria smithii Jacks 528
Zieria smithii subsp. (SF144 B.Gray 428). 516
Zieria smithii subsp. *tomentosa* J.A.Armstr. 528
Zieria southwellii J.A.Armstr.. 530
Zieria sp. (Amiens L.Pedley 1518) 509
Zieria sp. (Binjour P.I.Forster PIF14134) 533
Zieria sp. (Brolga Park A.R.Bean 1002) 489
Zieria sp. (Coominglah A.R.Bean 8959) 512
Zieria sp. (Flinders Peak S.L.Everist 1169). 527
Zieria sp. (Herberton J.A.Armstrong 1025) 524
Zieria sp. (Lamington G.Leiper AQ502702) 530
Zieria sp. (Monogorilby P.I.Forster PIF1004) 535
Zieria sp. (Mooloolaba G.Leiper AQ636552). 502
Zieria sp. (Mt Larcom N.Gibson TOI8) 480
Zieria sp. nov. (Mt William) 500
Zieria sp. (Pieter Botte M.Godwin C2471) 519
Zieria sp. (Ravenshoe E.W.Bick 116) 536
Zieria sp. (Russell River S.Johnson in 1892) 522
Zieria sp. (Sydney Heads A.R.Bean 2562) 492
Zieria sp. (Thornton Peak J.R.Clarkson 5556) 519
Zieria sp. (White Mt D.G.Fell+ DGF1257) 531
Zieria sp. 12 (sp. “L”; Russell River, S.Johnson s.n., 1892) 522
Zieria tenuis Duretto & P.I.Forst. 531
Zieria vagans Duretto & P.I.Forst.. 533
Zieria verrucosa J.A.Armstr. 535
Zieria whitei J.A.Armstr. ex Duretto & P.I.Forst.. 536